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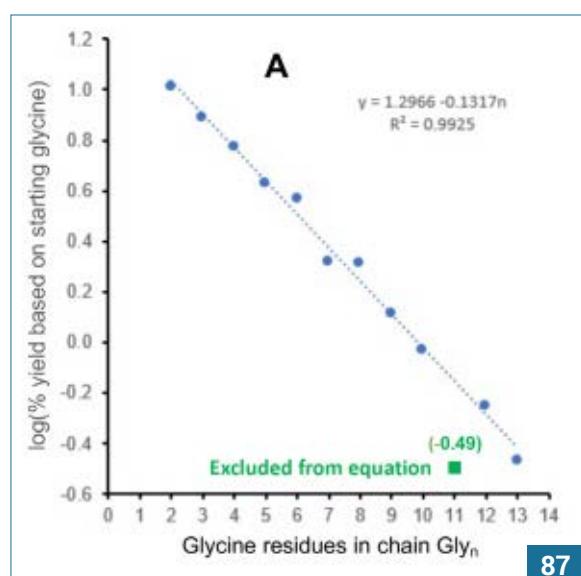


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Polar dinosaurs: evolutionary conundrums and biblical solutions

Michael J. Oard

Polar dinosaurs refer to dinosaur fossils found within the polar latitudes. Considering plate tectonics, paleolatitudes of the Northern Hemisphere were farther northward when Cretaceous System strata were deposited than they are today. In the Southern Hemisphere, polar latitudes would also include southeast Australia, New Zealand, and the Chatham Islands where dinosaur fossils have been found.¹

The evolutionary conundrum of cold winters but warm paleofauna

The existence of polar dinosaurs has raised at least four conundrums for the evolutionary paradigm. For instance, climate models indicate the polar latitudes would have been very cold during the Cretaceous winter, while the paleoflora and paleofauna indicate temperatures had to have been above freezing all year around:

“Paleobotanical evidence clearly indicates that during much of the Cretaceous northern polar temperatures on lands surrounding the Arctic Ocean were above freezing during the polar night. … Evidence for very warm Arctic Ocean waters (15 to 20°C) has been presented by Jenkyns *et al.* (2004). Proxy data indicating ocean temperatures of 30°C at 60°S latitude (Bice *et al.*, 2003) supports the idea of warm poles during much of the Cretaceous.”²

Hay believes that lower topography, higher ocean levels, and greenhouse gases, including carbon dioxide and methane, would have

maintained above-freezing winter temperatures.³ He also erroneously thinks that, considering the average lapse rate⁴ of the atmosphere of 6°C/km, the lower topography would have resulted in warm polar night temperatures. Even if this lapse rate could be applied, it would not have warmed the Arctic much because the air was so cold to begin with. As far as lower topography is concerned, the continental areas of North America and Eurasia are relatively low anyway. Besides, the polar night causes a temperature inversion to which the average atmospheric lapse rate would not apply. Despite all the possible variables that could be applied to cause polar warmth, the cold winter temperatures depend especially on one variable: the angle of the sun, and the evolutionary model cannot do anything about that for the Cretaceous.

Other evolutionary conundrums

Cold winter temperatures are one of several other conundrums. For instance, why would dinosaurs have even lived there, considering that most scientists believe dinosaurs to have been warm-climate animals? Polar dinosaurs have unleashed much speculation on Arctic coping

mechanisms. With long periods of darkness and photosynthesis cut off—and the resulting loss of vegetation—what would they have eaten? If dinosaurs were adapted to the cold, as the existence of polar dinosaurs suggests, how and why would they disappear from the whole earth at the end of the Cretaceous due to one meteorite impact? Partly for this reason, some scientists are moving away from the impact mechanism for dinosaur extinction and suggesting that dinosaurs were in wide decline well before the supposed very late Cretaceous impact.^{5,6} These are very difficult problems for evolutionary geologists to explain.^{7,8}

Alaskan polar dinosaurs

Many dinosaur fossils and tracks have been found in Alaska since 1980, and they are similar to those of dinosaurs found in the middle latitudes.^{9–11} They are especially abundant in the Prince Creek Formation, along the Colville River of the North Slope of Alaska, USA, at a paleolatitude claimed to be 85°N (69–70°N today). Countless dinosaur and bird tracks and a few pterosaur tracks are now known to exist in Denali National Park and



Figure 1. Eroded ‘clast’ of a hadrosaur track, Denali National Park, Alaska, USA

surroundings.^{12,13} They are found on multiple stratigraphic levels with evidence of erosion in some layers. There are even tracks that were more firmly lithified than their surrounding sediments and were subsequently eroded from their original positions to land elsewhere as ‘clasts’ in talus, which is extremely rare (figure 1).

Polar dinosaurs did not migrate

Many scientists have suggested dinosaur migration from the mid to the high latitudes each year as a solution to the conundrums. However, many evolutionary scientists think that this is unlikely.^{8,9} Still, no very small or baby dinosaurs had been found to support the idea that dinosaurs lived in the polar latitudes all year around.

But the idea of migration has finally been put to rest with the discovery of perinatal and very young dinosaurs from the Prince Creek Formation, Alaska.¹⁴ Evidence for eggshells and baby dinosaurs had not been found in the Southern Hemisphere paleopolar latitudes until recently.¹⁵ Two incomplete ornithopod perinatal, or possibly embryonic, femora have been found in New South Wales, Australia, complimenting ‘yearling’ specimens from Victoria, Australia. These three discoveries support high-latitude breeding and eliminate migration for polar dinosaurs.

Thus, “Dinosaurs were remarkably climate-tolerant, thriving from equatorial to polar latitudes.”¹⁶ Furthermore, a Chicxulub impact on the Yucatan Peninsula is an unlikely cause of dinosaur extinction, as many scientists have believed.¹⁷

Polar dinosaurs explained by the Flood

Because of the earth’s tilt, the Northern Hemisphere has never had enough light, warmth, or food to support dinosaurs, yet we find their fossils and fossil footprints in places like Denali, Alaska. The Creation/

Flood model has the most plausible explanation for why we find ‘polar’ dinosaurs. The most likely explanation is the dinosaurs and the paleoflora were transported northward on Flood currents during the Inundatory Stage of the Flood.^{18,19} Dinosaurs capable of swimming could have floated from low to high latitudes on strong currents that are laminar in the upper portion of the floodwater. They may have also hitched rides on log mats. Even in today’s relatively more steady conditions, a strong water current is capable of transporting a floating object from low to mid latitudes in as little as two days. An interesting point in support of this is that most of the dinosaur tracks and bones are from hadrosaurs and three-toed theropods, the dinosaurs most likely able to float and swim well since they had large lower bodies and no heavy horns to sink them.

Strong floodwater currents would also explain the abundant warm-climate vegetation and other animal fossils found in Alaska.^{20,21} In support of this idea a subtropical to tropical cycad leaf was recently found in southwest Alaska.¹⁰ Evidence for these northward currents is further shown by the long-distance trail of hard rocks that spread north from the Alaska Range.²² In addition, very thick sediments, well over 10 km thick, are found on the Arctic margin, indicating immense northward erosion and transport of sediment from Alaska,²³ pointing to northward currents at times during the Flood.

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Greenery beneath Greenland Ice Sheet?

Michael J. Oard

Camp Century, northwest Greenland, 120 km inland from the sea (figure 1), was where a significant ice core was drilled on the ice sheets. It was completed in 1966. It was drilled through 1,368 m of ice, 14 m of silty ice, and penetrated about 4.5 m of dirt below the ice. The dirt had two layers of diamictite, a poorly sorted mixture of particles ranging in size from clay to boulders, separated by a debris-rich ice layer. The diamictite core was ‘lost’ in a freezer for decades until it was accidentally discovered in 2017.¹

Vegetation beneath the Camp Century ice core

The researchers analyzed the diamictite core and were surprised to find twigs of trees and leaves, still with wax coatings in the dirt. Lead researcher Andrew Christ was quoted as saying:

“Ice sheets typically pulverize and destroy everything in their path ... but what we discovered was delicate plant structures—perfectly preserved. They’re fossils, but they look like they died yesterday.”²

The twigs could be from spruce or fir trees.¹

The Greenland Ice Sheet dated old

Climate models show that the Greenland Ice Sheet should have been stable for the past 2–3 Ma.³ Ice-rafted debris (IRD) in the deep ocean offshore caused the researchers to suggest that the ice sheet has existed since anywhere from the Eocene to the Miocene, 45–7.5 Ma.⁴ Scientists

also find IRD around Antarctica they claim is early Oligocene, about 33 Ma.⁵ Since the ice sheets are post-Flood, this suggests that much of the ocean bottom sediments could be post-Flood; at least sediments close to the coasts, no matter what the uniformitarian date, based mainly on considerations of the biostratigraphy of the microorganisms. Because uniformitarian scientists believe the ice sheet has been more or less in equilibrium for millions of

years, they assume that annual layers, distinct at the top of the ice core, thin considerably with depth down to about the thickness of a dime near the bottom. Therefore, the bottom of the ice is dated around 110–120 ka, but researchers come up with much older dates for the silty ice, soil, or rock below the ice. Their dates range from many hundreds of thousands to a few million years old.

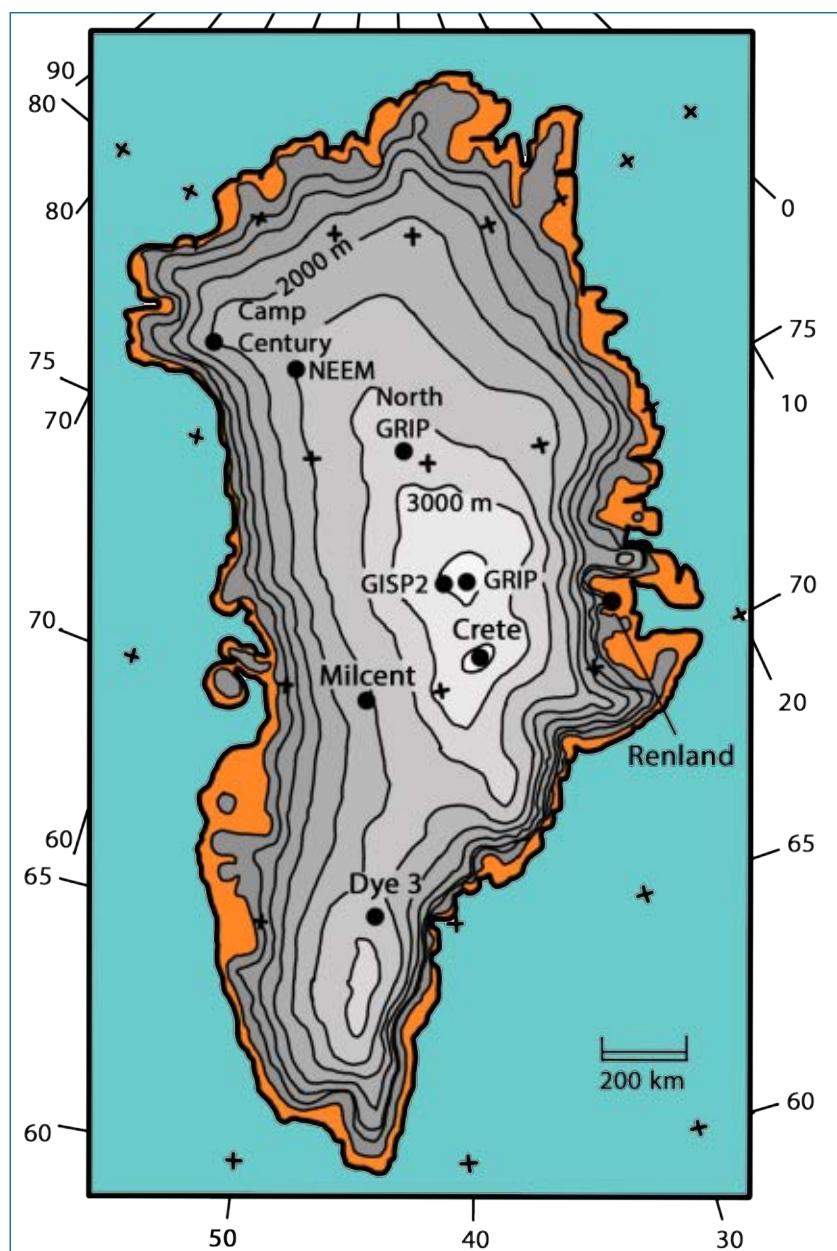


Figure 1. Map of Greenland showing ice thickness above sea level with major ice core locations

The researchers dated the bottom diamicton of the Camp Century ice core by cosmogenic isotopes, mainly *in situ* Be-10 and Al-26, and infrared-stimulated luminescence. The cosmogenic isotopes are formed by cosmic ray bombardment, as cosmic rays interact with atoms in the atmosphere.⁶ The isotopes generated attach themselves to aerosols in the atmosphere and fall onto the surface. The *in situ* cosmogenic isotopes, on the other hand, are formed as cosmic rays interact directly with atoms in the ground. The presence of *in situ* cosmogenic isotopes indicates that an area was unglaciated, since cosmic rays cannot penetrate very far into ice or rock in order to form the isotopes. The concentration of isotopes is interpreted to indicate how long the surface was ice free. The Be-10 values in the upper diamicton suggested that the area had been ice free at least once within the past million years. Analysis of the lower diamicton suggested that the area was ice free once in the early Pleistocene.

Since Al-26 decays faster than Be-10, researchers use the Al-26/Be-10 ratio as a ‘dating’ method. The half-life of the ratio is variably estimated as 1.4 Ma³ and 2.08 Ma.⁷ The ratio today is about 7.3, and the measured ratio in the upper diamicton was 4.5 and in the lower diamicton, 1.8. Based on the Al-26/Be-10 ratio, the researchers claim that the top diamicton is greater than 0.7 Ma and the bottom diamicton is less than 3.2 Ma, despite the bottom of the ice being only 110 ka. Infrared-stimulated luminescence could not be measured on the upper diamicton, but indicated that the lower diamicton was exposed to sunlight before 0.7–1.4 Ma.

Implications of the vegetation

The vegetation at the bottom of the Camp Century core and the various dates suggest that at least the northwest Greenland Ice Sheet, and possibly the rest of it, had melted in the recent past,

within the past million years: ‘Their results show that most, or all, of Greenland must have been ice-free within the last million years, perhaps even the last hundred-thousand years.’² It was warm enough during that period for trees and plants to grow. This deduction was supported by the oxygen isotope ratios in the bottom ice, which suggested that precipitation had fallen at much lower altitudes with much warmer temperatures than those at the current height of the ice sheet.

A warm, ice-free period is reinforced by fossils from marine and coastal sediments in Melville Bay, off the northwest Greenland coast, that documented a warm, forested period in the early Pleistocene. It is possible that this vegetation at the bottom of the ice core is from the Flood, since it would correspond with paleoflora evidence of temperatures 5–20°C warmer in the Pliocene of northern Canada, which is a likely result from the Flood.⁸

Other ice cores indicate mild temperatures and melting at the bottom

Information from the bottom of the other deep ice cores in Greenland indicates relatively warm temperatures and even ice-free conditions. Scientists dated 1.55 m of granite bedrock penetrated by the GISP2 ice core drilled in the Greenland Ice Sheet.³ Based on the accumulation of *in situ* Be-10, the secular scientists came up with a total time of exposure of 280 ka for the bedrock surface. This means that the ice sheet must have been totally, or almost totally, melted for a total length of time of at least 280 ka during the past 2.6 Ma. They think that since exposure is additive, this 280 ka of Be-10 exposure could have come in 10 ka increments during the numerous ‘interglacials’. DNA found at the bottom of several ice cores came from plants that would thrive with summer temperatures averaging 10°C.⁹ DNA and amino acids from the silty ice base

of the GRIP and Dye-3 cores in central and southern Greenland, respectively, suggests forests and insects:

‘We show that high-altitude southern Greenland, currently lying below more than 2 kilometers of ice, was inhabited by a diverse array of conifer trees and insects within the past million years. The results provide direct evidence in support of a forested southern Greenland.’¹⁰

Applied to the global warming scare

The researchers, of course, applied the new results to the global warming scare:

‘The discovery helps confirm a new and troubling understanding that the Greenland ice has melted off entirely during recent warm periods in Earth’s history—perhaps like the one we are now creating with human-caused climate change.

... ‘Greenland may seem far away,’ says UVM’s Paul Bierman, ‘but it can quickly melt, pouring enough [sic] into the oceans that New York, Miami, Dhaka—take your city—will go underwater.’¹¹

Bierman also stated that ‘fighting’ global warming is an urgent problem for the next 50 years. But the facts of global warming show that there has only been an increase of about 1°C since 1880, if you can believe the long-term temperature records, which have endemic warm biases.¹² People should weigh all the evidence to determine the amount of actual global warming, its future projections, and whether we have time to do more research.¹³

Creation science interpretation of the Greenland Ice Sheet

The oxygen isotope ratio, roughly proportional to temperature,¹⁴ in the six deep ice cores on Greenland Ice Sheet shows only one Ice Age, as posited by the biblical worldview.¹⁵ Near the bottom, warmer temperatures of

about 6°C at GISP2¹⁶ and 7.5–8.5°C at NEEM¹⁷ are inferred because of more positive oxygen isotope ratios. This warmer period is sometimes suggested to be from the previous interglacial, provided that the bottom dates are ‘old’ enough for this to be the case, a little older than 120 ka. So, information on previous ice ages, if they occurred, is non-existent:

“... however, that history [of the Greenland Ice Sheet] is poorly known before the last interglacial. Most knowledge [of previous ice ages] comes from interpretation of marine sediments, an indirect record of past ice sheet extent and behavior.”¹⁸

One ice age is also shown in the West Antarctic Ice Sheet cores.¹⁹ It is the deep cores from the East Antarctica Ice Sheet that supposedly show up to eight ice ages based on wiggles in the deuterium isotope ratio, especially in the Dome C ice core, which has more wiggles than the others. However, the first four wiggles from the bottom of Dome C are unimpressive, and the oscillations were simply ‘dated’ by comparing oxygen isotope oscillations in deep-sea cores, which were ‘dated’ assuming the Milankovitch mechanism for multiple ice ages. The East Antarctic dates, as well as the deep-sea core dates, are based on circular reasoning.

The biblical Ice Age model would also expect very thick annual layers in the Ice Age portion of the deep ice cores before thinning, on the order of 5 m of ice in Greenland¹⁵ and 10 m of ice in East Antarctica.¹⁹ So, the uniformitarian model that requires deep time is counting storm and intrastorm layers in the Greenland ice cores.²⁰

The vegetation and insect debris discovered at the bottom of the ice core are predicted by the biblical Ice Age model since post-Flood warm water would have surrounded Greenland. It cooled as the Ice Age developed. Glaciation of all of Greenland would

have taken 100–200 years, beginning in the mountains and spreading into the low areas of Greenland, where the ice cores were drilled.¹⁵ A few hundred years between the end of the Flood and the encroachment of Ice Age glaciers into the lowlands would have provided enough time for vegetation, including small trees, to grow.

The luminescence dating technique is questionable at best. This applies to thermoluminescence,²¹ but likely would apply to other measurement techniques of luminescence as well. The Al-26/Be-10 ratios for the upper and lower diamictite indicate anywhere from 0.7–3.2 Ma of radiometric decay at today’s rate. The low ratios, compared to today, would indicate accelerated radiometric decay continued into the Ice Age.⁶ Since the bottom silt likely collected over about 200 years before glaciation,¹⁵ it is likely that the significantly higher ratio in the upper diamictite indicates that accelerated decay was decreasing rapidly early in the Ice Age.

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Plans underway to drill supposed 1.5-million-year-old Antarctic ice

Jake Hebert

To better understand ‘climate change’, uniformitarian glaciologists intend to drill another deep ice core in East Antarctica, one reaching ice they believe to be between one and 1.5 Ma old.¹ Creationists should pray they are successful!

Currently the oldest Antarctic ice dated with supposed ‘high confidence’ is said to be 2.7 Ma old.^{2,3} However, this is ‘blue ice’ (named because of the ice’s brilliant bluish colour), obtained from a region where ice accumulation is thought to be roughly balanced by ice loss. Because ice is continually ablated from this region of Antarctica, glaciologists cannot obtain a continuous ice record, and analysis of retrieved blue ice is not trivial:

“In such blue ice areas—just 1% of the continent’s surface—the ice flows across rocky ridges, *tipping the record on its side*. Deep, old layers are driven up, while wind strips away snow and younger ice, revealing the lustrous blue of compressed ice below. *But these contortions also confound the neat ordering of the annual layers—making it impossible to date the ice by counting them* [emphases added].”²

The fragmentary nature of the ‘blue ice’ record only allows scientists to obtain ‘snapshots’ of past ice, rather than a much more valuable continuous record. The oldest presumed ice from a *continuous* ice core record is the ice at the bottom of the EPICA Dome C core, said to be 800 ka old.⁴

So, why pray for their success? If glaciologists succeed in drilling this new ice core, it will likely strengthen the case that the uniformitarian age assignments for the ice cores are greatly inflated.

Ice core overview

Since the ice sheets actually started forming during the post-Flood Ice Age, the Greenland and Antarctic ice sheets can be no more than 4.5 ka old.⁵ Yet uniformitarian scientists assign ages of more than 100 ka to deep Greenland ice near bedrock,^{6,7} and multiple hundreds of thousands of years to the deep ice cores in East Antarctica.^{4,8,9}

Superficially, the deep ice cores from Greenland seem to present a strong argument for great age, because these ages were supposedly obtained by ‘simple’ counting of annual layers. However, creation researchers have plausibly argued that uniformitarian glaciologists may be greatly over-counting the true number of annual layers, especially in the bottom halves of the cores, which contain the greatest amount of presumed ‘time’.^{5,10-12}

In East Antarctica, low snowfall rates prevent visible (and countable) layers from being preserved in the deep Antarctic cores.^{13,14} Uniformitarians therefore rely on theoretical age depth models which implicitly assume vast ages for the ice sheets.¹⁵⁻¹⁷

Tephra and inflated core ages

Three continuous ice core records with bottom purported ages greater than 400 ka have been drilled in East Antarctica: the Vostok, EPICA Dome C, and Dome Fuji ice cores. Within these ice core records are layers of volcanic ash and debris called tephra. When the locations of tephra layers within these three cores are plotted against their assigned uniformitarian ages, there is a dramatic apparent decrease in tephra-layer frequency

as one goes deeper into the supposed ‘prehistoric’ past (figure 1).¹⁸⁻²⁰

Via uniformitarian reckoning, one would expect frequencies of tephra deposition to be roughly constant in time, albeit with a random element imposed on the pattern. This is not the case and is a clear violation of the uniformitarian maxim that ‘the present is the key to the past’. Secular glaciologists are forced to argue that East Antarctic tephra deposition, for some reason, was much rarer in the distant past.¹⁹

However, this dramatic decrease in tephra frequency is exactly what one would expect if uniformitarian age models are assigning inflated ages to the ice cores. These ages are *especially* inflated in the bottom halves of the cores, which typically contain *nearly all* the time assigned to them.²¹ This apparent drop in frequency is a *systematic error* resulting from a grossly inflated uniformitarian timescale.

For this reason, creationists should expect this same pattern to show up in this proposed new Antarctic ice core.²² Moreover, such a pattern in an ‘older’ core would be even harder for uniformitarians to explain. It’s one thing to claim that, for some unknown reason, volcanic tephra deposits were extremely rare between 200–800 ka ago (figure 1). But it’s even harder to plausibly claim Antarctic tephra deposits were exceedingly rare (or even non-existent) for a *million* years or more, only to ‘erupt’ in frequency (pun intended) within the last 200 ka!

Moreover, creation researchers have already found preliminary evidence that uniformitarian age models are implying ridiculously long durations to some tephra deposits. Explosive volcanic eruptions (which deposit tephra and ash) are very short geological events, and ashfall durations should be quite short, even when atmospheric dispersion times are taken into account. For someone

not present in order to see the volcanic eruption, the inferred time over which he/she determines a tephra layer to have been deposited depends on both the actual, true time of tephra fallout, as well as distance from the source volcano. A tephra layer deposited right next to a source volcano will be quite thick, and failure to recognize the nearness of the source volcano could result in the thickness being incorrectly interpreted as the result of an ashfall of very long duration. However, tephra layers rapidly (more or less exponentially) decrease in thickness with increasing distance from the source volcano.²³ And it is sometimes possible to identify the source volcano by examining the chemical composition of the tephra.⁹

As a case in point, a rough uniformitarian age model implies that one particular tephra layer in the Dome Fuji core was deposited over five years or so. Moreover, this apparent lengthy duration cannot be attributed to the nearness of the source volcano, which scientists think is Mt Berlin, West Antarctica, almost 3,000 km

(1,860 mi) away.²⁰ But has anyone ever observed ash or tephra fallout at a single location lasting this long? This is another clue that uniformitarian age models are assigning way too much time to the deep ice cores.

An opportunity for creationists

Depending on its thickness and the depth at which it is located, a tephra layer near the bottom of this proposed East Antarctic core could potentially provide even more evidence for inflated secular timescales. As a hypothetical example, suppose a tephra layer is located in ice said to be 1.4 Ma old. Yet by creationist reckoning, suppose the age of that ice is roughly 4 ka. The timescale at the tephra layer's location would thus be inflated by roughly a factor of $1,400,000 \div 4,000 \sim 350$. A tephra layer at this depth, that was actually deposited over, say, two weeks, would seem to have been deposited over 700 weeks—about 13 years! And what if chemical analysis revealed that the tephra originated from a distant—not a

nearby—source volcano? In that case, the apparently absurd tephra fallout time could in no way be attributed to the nearness of the source volcano. It would then be painfully obvious that there is something *badly* wrong with the secular timescale.

Hence, the possibility of another long, continuous ice core from East Antarctica should excite creationists, and we should pray that the Lord Jesus would grant uniformitarian glaciologists success in drilling such a core. Although secularists have long used deep ice cores as a club with which to beat Bible-believing Christians, this could turn out to be yet another example of how even “the wrath of man shall praise” the Lord (Psalm 76:10).

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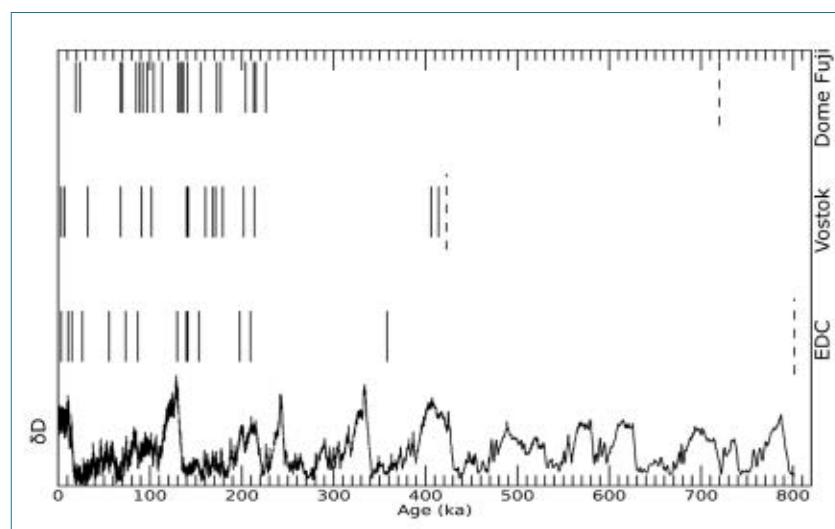


Figure 1. Tephra layers in the Antarctic Dome Fuji, Vostok, and EPICA Dome C cores, along with the (relative) delta deuterium signal from EPICA Dome C, as a function of uniformitarian age assignment. Dashed lines indicate greatest approximate ages/depths of core sections that were inspected for tephra layers. Dark tephra bands indicate multiple, closely spaced tephra layers. See reference 18 for details.

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Attempted rescue of the impact model for the origin of the moon

Michael J. Oard

There have been four proposed mechanisms for the formation of the moon. Three are considered disproven: (1) the fission theory, in which the moon separated from the earth during rotation, (2) the capture theory, in which the earth captured a wandering moon, and (3) the condensation theory, in which the earth and moon formed from the condensation of the same dust cloud during the formation of the solar system.¹ Another proposed mechanism is that the moon formed after a collision between the earth and a Mars-sized object that ejected debris out to the

current orbit of the moon (figure 1). The debris coalesced forming the moon and the earth. This mechanism was accepted in the late 20th century, not because of the merits of the theory but because of the shortcomings of the other three theories.² The ‘giant impact hypothesis’ has now dominated for over 30 years, but not without major problems for which revised models have been suggested.³

Problem that the moon is too similar to the earth

Since the geochemical properties of the moon are so similar to those of the earth, the giant impact hypothesis has run into problems.⁴ The moon should have a similar composition to the impactor, which should be much different than that of the earth. Numerous computer models have been applied to figure out why the earth and moon are so similar.^{5–7}

Like most geophysical and astrophysical models, these models are simplified. However, with enough tries, a ‘good’ model was developed



Image: NASA / Public Domain

Figure 1. An artist's conception of a Mars-sized body slamming into the earth to form the moon

to better explain the moon's size, orbital angular momentum, and overall composition. But with more precise isotopic measurements, such as oxygen isotopes, the rocks of the moon and Earth are too much alike. Such a 'coincidence' has produced a modern crisis:

"This has created a modern crisis in the giant impact concept: if more than half of the moon's material came from the impactor, how can the moon's isotopes be nearly identical to the earth's?"⁸

Crisis 'solved' by more computer simulations

After numerous computer simulations, some scientists now think they have solved the crisis by postulating the Mars-sized object hit a 'magma ocean' on the early Earth.⁹ In this way, more of the earth material would end up forming the moon. Most models of Earth's formation postulate a mantle magma ocean caused by the gravitational potential energy of numerous planetesimals transformed into heat. And because a magma ocean is supposed to have more liquid FeO, which accounts for the enrichment of FeO on the moon by a factor of two, it 'solves' the problem of higher FeO content on the moon.

In the new simulation with a magma ocean, 70% of the moon would be Earth material, instead of the 40% from previous models. Melosh thinks that the greater proportion of Earth material ejected to form the moon may still not be good enough to explain nearly identical isotopes:

"Although the work of Hosono *et al.* is an important step towards understanding why the earth and moon are so isotopically similar, it does not wholly resolve the problem. The large changes they report from modifying the SPH code appear to be at odds with the previous validation of the SPH method. The thermodynamic description of the melt used by Hosono *et al.* must

also be improved in future work, to incorporate better thermodynamic models that are valid over the entire range of pressures and temperatures involved in the impact."¹⁰

The SPH (Smooth-Particle Hydrodynamic) code includes a "complex necessarily 3D geometry of self-gravitating fluids flowing at supersonic speeds."¹⁰ And Hosono *et al.* modified it. It would be very difficult to get such a process correct, which is one reason why Melosh is skeptical.

Other problems for the origin of the moon revealed

Hosono *et al.* state that the many models to explain the problems for the naturalistic origin of the moon are *ad hoc*, with several glaring problems remaining:

"It should be noted that in all of these models rather *ad hoc* assumptions are made about the mechanics of GI [giant impact] to explain the chemical similarities between the moon and Earth. It is therefore difficult to explain the angular momentum of the Earth-Moon system in these models."¹¹

Further, the planetary scientists say that the moon lacks an iron-rich core, which may present a problem in explaining the ancient magnetic field of the moon.

Creation science implications

So much research and effort put into explaining the origin of the moon shows just how desperate naturalistic scientists are to explain its origins. Numerous computer simulations with different assumptions and variables once in a while come up with a close solution, such as the one by Hosono *et al.* These researchers claim that previous models were *ad hoc*, but the commentary by Melosh indicates that the Hosono *et al.* model is also *ad hoc*.

The numerous computer gyrations are really showing that a naturalistic origin of the moon is extremely

difficult, if not impossible. The best explanation is given by the Word of God: "And God made two great lights" (Genesis 1:16–18).

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Central rotation in globular clusters: an indicator of relative youth?

Jake Hebert

Globular clusters are beautiful, spherically symmetric star clusters resembling celestial snow globes. Star density is greatest near the cluster centre, and this density drops off with increasing distance from the cluster centre. Approximately 150 globular clusters orbit our own Milky Way galaxy, including the Messier 80 globular cluster in the constellation Scorpius (figure 1).

Although they do not understand how or where globular clusters formed,¹ uniformitarian astronomers have long claimed that globular clusters are among the oldest objects in the universe, with typical ages greater than 10 Ga. In fact, uniformitarian astronomers sometimes *define* globular clusters as old star clusters found in the bulges and halos of galaxies.² Recently, some uniformitarian astronomers have suggested globular clusters might be four billion years younger than previously claimed.^{3,4} But in any case, by secular reckoning, their ages are measured in multiple billions of years, and it is generally agreed that the globular clusters orbiting our own Milky Way galaxy have ages of at least 11 Ga.⁵

The well-known ‘neutron star retention problem’ is the presence of higher-than-expected numbers of neutron stars in globular clusters. This is a possible indicator that globular clusters are much younger than claimed by secular scientists, and it has already been discussed in the creation literature.⁶

Rotational signatures

Eight years ago, another possible indicator of the relative youth of globular clusters appeared in both the popular science press and in the technical literature.^{7,8} Astronomers affiliated with the University of Texas and the Max Planck Institute for Extraterrestrial Physics found evidence, via line-of-sight kinematic studies, that stars in the cores of 11 Milky Way globular clusters were orbiting a preferred axis of rotation. Astronomers have already detected rotational signatures in the outer regions of some nearby well-known globular clusters. However, they were surprised to see such a rotational signature in the central parts of these clusters.

According to textbook theory, stars in globular clusters exert gravitational ‘tugs’ on one another as they undergo 2-body interactions. These tugs nudge the orbiting stars, changing their trajectories little by little. Given enough time and enough interactions, these gravitational tugs will eventually ‘erase’ any ‘memory’ of the stars’ original orbits, completely randomizing their trajectories. The time for this effect to become significant is called the *relaxation time*. Depending on the method of derivation, formulae for the relaxation time can vary somewhat, but a common expression⁹ for the relaxation time is:

$$t_{\text{relax}} = \frac{0.065 \langle v^2 \rangle^{\frac{3}{2}}}{\rho \langle m \rangle G^2 \ln(0.4N)} \quad (1)$$

In the above equation, $\langle v^2 \rangle$ is the average (by mass) square of the velocities of the stars in the cluster, ρ is the mass density of the cluster, $\langle m \rangle$ is the average star mass in the cluster, G is the gravitational constant, and N is the number of stars in the cluster. The derivation of this formula involves analysis of 2-body interactions and is ubiquitous on the internet.

Because of the higher densities ρ within the cores of globular clusters,

estimated core relaxation times should be shorter than relaxation times for the outer, less dense, parts of the cluster, as well as for the clusters as a whole. Estimated relaxation times for the central regions of globular clusters are on the order of one million to a hundred million years,¹⁰ and N -body computer simulations suggest that central rotation should be erased after a few relaxation times.¹¹

To make matters worse for secular astronomers, some physicists and astrophysicists have long argued that “self-gravity significantly speeds the relaxation of stellar systems through excitation of large-scale modes.”¹² Because the classically-derived equation ignores self-gravity and other effects, they argue that it is underestimating relaxation rates, thereby overestimating cluster relaxation times.^{13,14} If true, this would make the core relaxation times even shorter, putting still more stress on the secular story. However, some of these scientists seem to have reversed themselves, recently arguing that these other effects do not make much of a difference to relaxation times, at least in some cases.¹⁵

Contradiction between rotation signatures and ages of globular clusters

In any case, there is an apparent contradiction between these central rotation signatures and the presumed ages of these globular clusters. The accompanying press release said that *none* of the current theoretical models (as of 2014) predicted “such a ubiquitous and strong rotation”.⁸ A phenomenon called ‘core collapse’ can erase rotational signatures, but none of the 11 globular clusters in the study are thought to have undergone core collapse.

Needless to say, the authors of the study were very surprised. Lead author Maximilian Fabricius, said the result was ‘astonishing’.⁸ Co-author Eva Noyola of the University of Texas was quoted as saying:



Image: NASA and ESA.

Figure 1. Hubble Space Telescope image of Messier 80, said by uniformitarian astronomers to be 12 Ga old. M80 is exhibiting inner core rotation, even though such rotation should theoretically have been erased eons ago, by secular reckoning.

“Theory and numerical simulations of globular clusters indicate that any central rotation should be erased on relatively short timescales. … Because these globular clusters were formed billions of years ago, we would expect that any rotation signature would have been eradicated by now. Even though previous measurements showed some rotation in a handful of systems, they only probed the motion of stars in the outer regions.”⁸

As best as I can tell, the only reference in the creation literature to this phenomenon is in a couple of popular-level articles I wrote.^{16,17} I am a little surprised that this hasn’t received more attention in the creation astronomy community.

Since then, evidence of internal rotation in globular clusters has increased. In 2018, one survey found strong evidence ($>3\sigma$ confidence level)

of rotation in 13 out of 22 globular clusters,¹⁸ and a second survey found strong evidence ($>3\sigma$ confidence level) for internal rotation in 11 out of 51 globular clusters, as well as 11 more clusters having evidence of internal rotation at the 2σ confidence level.¹⁹ At least seven papers have reported such internal rotation results since 2014.²⁰

Conclusion

This is evidence that at least some globular clusters are much younger than their secular age assignments. Of course, if God used some kind of time dilation effect to get distant starlight to us quickly, these globular clusters could still be millions of years old as measured by clocks in deep space. But it’s just one more indication that, even in a possibly time-dilated universe, secular age assignments are still greatly inflated.²¹

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The most ancient Proto-Hebrew inscription ever discovered!

Gavin Cox

Recently, *Associates for Biblical Research* (ABR) announced an extraordinary, but tiny, discovery of a folded lead tablet. It beautifully corroborates an intriguing episode narrated in Deuteronomy 11:29, 27 and Joshua 8:30.¹ Here, Scripture records that, just after the people entered the Promised Land, blessings and curses were shouted out to Israel from two mountain tops, Gerizim (blessings) and Ebal (curses). On Mt Ebal, Joshua built an altar to the Lord and renewed the Mosaic Covenant (Joshua 8:30). ABR believes their new discovery is likely linked to this event or to a similar ritual in its aftermath.²

The ABR archaeologists found the small tablet in 2019 (see figure 1) on Mt Ebal using a process called wet sifting. The c. 2 x 2 cm (0.79 in²) tablet was discovered in archaeological material, including much plaster, within a foot-shaped enclosure (see figure 2) containing two previously excavated sacrificial altars,³ one more ancient than the other.

The lead of the tablet was analyzed, which determined the metal came from Greek mines dating from 1400–1200 BC. The dating of the tablet is consistent with an early Exodus date (1446 BC) and (after 40 years of wilderness wandering) the first year of Israel's Canaanite conquest of 1406 BC—during the Late Bronze I–II period (LBI–II). Inscribed lead tablets are also known from the Hittite Empire and Neo-Hittite states dating from the 14/13th–8th centuries BC (located in modern Turkey and northern Syria)—adding further reason to accept the Israelite tablet's antiquity.

Because the folded lead strip was impossible to unfold without destroying it, Daniel Vavrik and three colleagues



Photograph by Michael C. Ladd

Figure 1. Small, folded tablet found in 2019 on Mt Ebal

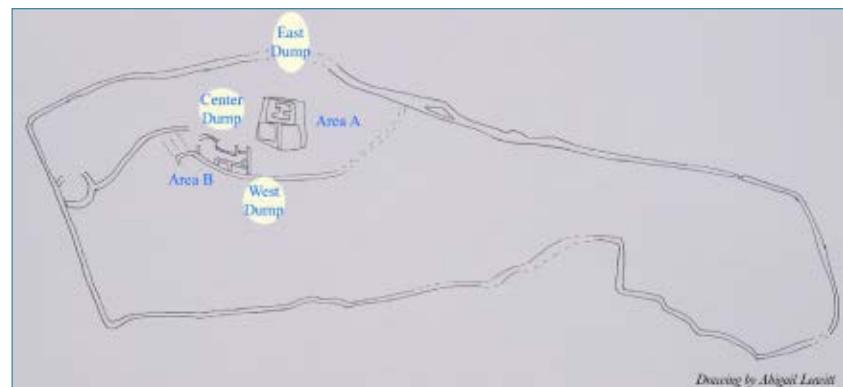


Figure 2. Foot-shaped enclosure, containing two previously excavated sacrificial altars, where the lead tablet was found.

from Prague's Academy of Sciences in the Czech Republic used advanced imaging techniques involving thousands of tomographic scans, to visualize hidden text on the inside surfaces. Scott Stripling, ABR's Director of Excavations, Pieter Gert van der Veen of Johannes Gutenberg-Universität Mainz, and Gershon Galil of the University of Haifa collaborated to translate the writing. The text forms a passage, described as 'chiastic parallelism', a literary structure in which words are repeated in reverse order. Most importantly, it contains the name of the God of Israel, spelled twice in its short form 'YHW'.⁴

“You are cursed by
the God YHW, ...
You will die, Cursed
you will surely die.
Cursed you are by YHW.”

The folded lead strip's wording⁵ likely represents a legal oath, designed to bind the oath-keeper(s) to keep the Law of Moses by invoking the covenant curses. Both covenant blessings and curses were fully accepted as incentives to keep the covenant.

According to ABR, the inside surfaces of the amulet contain 44 proto-alphabetic letters (a script which precedes paleo-Hebrew), and is centuries older than the oldest known Hebrew texts from ancient Israel. Douglas Petrovich, also an associate with ABR, has been working on even older proto-consonantal scripts found in Sinai dated to 1842 BC.⁶ These were featured in the film *Patterns of Evidence: The Moses Controversy*.⁷ All this evidence is highly significant, because many liberal theologians postulate there was no evidence of an alphabet in which to write during the LBI–II period, hence, the Bible must have been written much

later than Moses—in contradiction to Jesus's clear statement in John 5:46. Furthermore, the divine name *YHW* occurs at an Israelite covenant site of LBI-II age. This new discovery forever buries skeptical claims of the late formation of the Bible, or of Israel as a nation. It cannot be overstated how important this artefact really is: it truly is “one of the greatest discoveries to ever come out of the Holy Land.”⁸

ABR have yet to publish their translation of the outermost tablet surface text—which may reveal to whom the tablet belonged, who it was written by,⁹ or to whom it was addressed. We will wait with anticipation the publishing of their textual analysis (hopefully by the end of 2022)¹⁰ and for further exciting archaeological discoveries on Mt Ebal!

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2. The content of this article was updated on the basis of the current status of research on the lead tablet by ABR, special thanks to Pieter Gert van der Veen.
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4. A final translation of the inside inscription will appear in Part A of a technical article on the lead tablet by the end of 2022. The outside inscription (currently in preparation) will appear in Part B (2023).
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Blushing— another evolutionary enigma

Jerry Bergman

Blushing is a reddening of the skin of the face caused by dilation of the facial blood vessels which become engorged with blood, usually due to embarrassment or shame.¹ The origin of blushing has long been an ‘evolutionary enigma’. It bothered Darwin for most of his working life because this trait was yet another factor that differentiated humans from our putative closest relatives, the apes.² And it is yet another trait that is unique to humans—no evidence exists that any animal blushes. In Darwin's words, “Blushing is the most peculiar and the most human of all expressions.”³ He also concluded that some animals may appear to blush, but their reaction is very different than blushing.

Darwin recorded his first notes on blushing as early as 1838, writing he believed that “dark-skinned people surely blush just as Europeans do, and that animals do not.” He was certain that he had seen a Tierra del Fuego woman blush when he visited their country during his five-year voyage on the *Beagle*.⁴

Darwin devoted an entire chapter to blushing in his book, *The Expression of the Emotions in Man and Animals* (figure 1). He concluded blushing was a uniquely human characteristic that appeared to defy evolution for several reasons. These reasons include that no one had been able to explain *why* something like blushing, which most often does not help—and may even hurt—the blusher, would evolve. In contrast to most emotional responses, blushing is not a conscious behaviour.

As Darwin acknowledged, we cannot cause a blush.⁵ Rather, it is produced by the autonomic nervous system, “which is completely beyond our control”.¹

“The prevailing view in Darwin's time was that the blush was part of God's design to expose human shame”.⁴ Since Darwin rejected that explanation, he attempted to produce another reason, but, in the end, failed. This failure was a concern to Darwin because he correctly concluded that “The tendency to blush is inherited.” Thus, it could not be explained away due to learning.⁵

Evolutionary explanations

The obvious question for evolutionists is: What specific evolutionary advantage does blushing confer to the person that blushes? One explanation is closed off by the fact that blushing is largely invisible among dark-skinned people, consequently ruling “it out as an effective sexual signal.”⁴ Another issue the evolutionary view does not

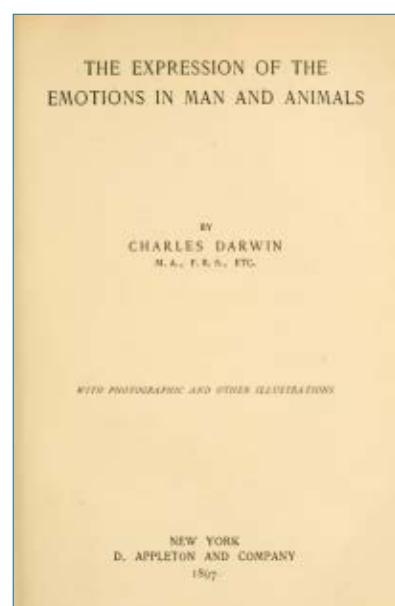


Figure 1. Cover of Charles Darwin's *The Expression of the Emotions in Man and Animals*. Darwin devoted the entirety of chapter 13 to the subject of blushing.

explain is that some people blush very easily; others blush far less often, or not at all. To formulate an evolutionary explanation, Darwin surveyed his “friends and correspondents about this ‘most peculiar and most human of all expressions’”, asking such questions as “whether children blush, and if they do, but not from birth, at what age do they start.”⁴ He even asked some of his correspondents if blind persons blush. From this research, Darwin concluded, after an examination of persons “in whom scar tissue or albinism allowed the coloration to show through” that “blushing was not dependent on skin colour”.⁵

From his studies, Darwin also observed that the *appearance* of a blush is usually confined to the face and neck, but the person blushing may *feel* as if his entire body is blushing.⁷

An example is

“... the thigh of an aroused nymph [a very sensitive, gentle person] might well become *flushed* owing to a similar effect of increased blood flow through her capillaries, but this has a physiological, rather than [a] mental, cause, and so is not a *blush* [emphases in original].”⁸

After Darwin’s research was completed, he

“... concluded that blushing arises from the human ‘habit of thinking what others think of us.’ It was not a result he was especially happy about, as it emphasized the uniqueness of human consciousness over our evolutionary connection with other species.”⁹

Modern research

Darwin’s theory did explain several observations, including “why infants do not blush, but children do; why the mentally retarded seldom blush, but blind people do; why we tend not to blush when we are on our own, but can nevertheless blush at an embarrassing memory.”¹⁰ However, what Darwin’s explanation did not achieve “was

to explain why we find blushing so attractive in others, which, for Darwin, interested as he was in the mechanisms and effects of reproduction, was surely the point.”¹¹ These questions have been answered by research which refers to the cheeks as “the part of the face that is most likely to expose one’s true feelings because emotional feelings are prominently displayed there.”¹²

At the physiological level, blushing can be understood as the release of *adrenaline* in response to an emotional trigger. The *adrenaline* causes the dilation of the capillaries that carry blood to the body, including the skin. The increased blood brought closer to the skin surface is what causes the blush.¹⁰

Blushing has both positive and negative psychological effects. Specifically,

“... the *positive* side of your blush is that you are communicating something important about what you feel. Blushing is an *honest* response ... because it is a distinct signal of sincere regret; it signals to others that you acknowledge your shame, mishap, or social wrongdoing, and in doing so, it promotes trust and positive judgments by observers [emphases in original].”¹¹

This research has shown that although “Darwin attributed no adaptive function to the blush (and by implication, embarrassment)”, he was wrong.¹² Psychological research on subjects has concluded that embarrassment caused by blushing “serves an appeasement function and is used creatively in complex social interactions” to facilitate producing trust, forgiveness, and succorance.¹²

Conclusions

Scientists today can accurately “measure facial capillary blood flow, and even the temperature of rosy cheeks, but are still not much closer to an answer” to both the problem

of why people blush and its possible evolutionary origins.⁸ Part of the problem in answering this question is the “extreme subtlety and complexity of the nervous control of [facial] expressions”, including blushing.¹³ In summary, the best explanation for a blush is the view that prevailed in Darwin’s time, namely it is part of God’s design to help communicate one’s emotions to others, including shame. The psychological research reviewed above supports this conclusion.

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Darwin's unpaid debt to Patrick Matthew

Science Fraud: Darwin's plagiarism of Patrick Matthew's theory

Mike Sutton

Curtis Press, Great Yarmouth, UK, 2022

Andrew Sibley

A new book by Dr Mike Sutton, *Science Fraud: Charles Darwin's Plagiarism of Patrick Matthew's Theory*, claims to provide fresh evidence that Darwin plagiarized the work of Patrick Matthew.¹ Dr Sutton has a Ph.D. in criminology, has worked in the UK Home Office, and has advanced a number of arguments in a previous book *Nullius in Verba* relating to Patrick Matthew (figure 1).² The release of this latest book on 12 February 2022 has been reported in several mainstream UK newspapers, such as the *Mail on Sunday* and *The Times*.³ The book, *Science Fraud*, is more focussed on Darwin's plagiarism of Patrick Matthew's work, but much of the material is in the former work, *Nullius in Verba*. It would have been helpful if Sutton had made it easier to determine what is new in *Science Fraud*. In this latest book he also responds to critics of the previous work and accuses some secular researchers of plagiarism of his own work (pp. 17–19).^{4,5}

Creation Ministries International has commented on Darwin's plagiarism in the past, including with references to Sutton's previous work.^{6–8} The 2015 paper by Dominic Statham in the *Journal of Creation* discusses much of Sutton's research in *Nullius in Verba* and previously published papers and research by others; it is worth reading for an overview (see also Mike Sutton's letter, and Dominic Statham's response⁹). In his latest

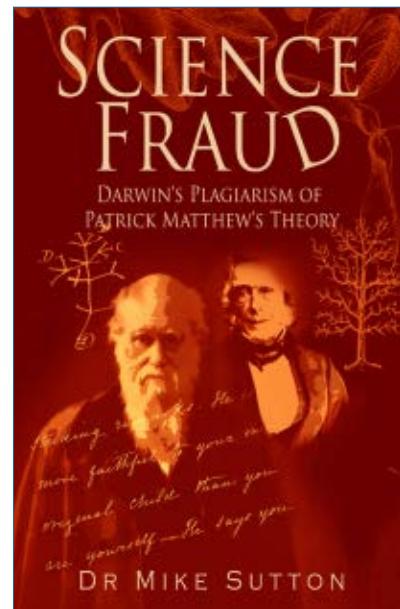
book he comments graciously on the misunderstanding with Dominic, but observes that the publication *Biological Journal of the Linnean Society* has acted less ethically, suggesting that others may be surprised that a creationist publication would show greater integrity than a science journal (pp. 17–19). We would wonder why he should be surprised by the good faith of a Christian organisation in moral matters.

In the early 19th century, Matthew became a landowner and agriculturalist, having inherited the Gourdiehill estate in Scotland from his uncle, Admiral Duncan. His work as the estate manager included nurturing fruit trees and growing crops of grain.¹⁰ Like Darwin, his wealth allowed him the time to develop scientific theories and write books. He was probably an old-earth creationist and believed that multiple catastrophes had forced changes in plant and animal life over 'millions of ages'.¹¹ Unlike Darwin, Matthew seems to have had sympathy for intelligent design in guiding change over the various epochs.^{9,12}

Darwin's plagiarism and excuses

The evidence cited by Sutton relates to claims that Darwin did not know about Matthew's prior work; *On Naval Timber and Arboriculture (NTA)* (1831). Using tools for data analysis, Sutton shows that both Darwin and Wallace plagiarized Matthew's work. There are a number of assertions that Sutton makes in his latest book.¹

Sutton shows that when Matthew challenged Darwin on the priority of the work Darwin's response was that the work was so obscure that no one had heard of it, and that what was published was only in the appendix (pp. 213–223).



Both of these claims can be shown to be false according to Sutton, as can the claim that Darwin continued to make inadequate defensive excuses for his conduct in private letters. A number of close contacts of Darwin had evidently read Matthew's work, including Robert Chambers.

Sutton is further critical of the science establishment that worked to promote the Darwin narrative—Darwin was turned into an icon or idol of science at the expense of others. He suggests that the same active censorship is still at work as the scientific establishment works to protect the reputation of Darwin, despite the evidence of plagiarism. In his criticism of the action of secular scientists, he quotes Dempster: "The suppression of the work of Patrick Matthew since 1831 raises doubts about the so-called intellectual integrity of many scientists"¹³ (p. 23).

This correspondence between Darwin and Matthew occurred several months after the publication of Darwin's work, *On the Origin of Species*. Matthew had replied to a *Times of London* review of Darwin's book that had been extensively quoted in the *Gardeners Chronicle and Agricultural Gazette* in the edition of 3 March 1860.

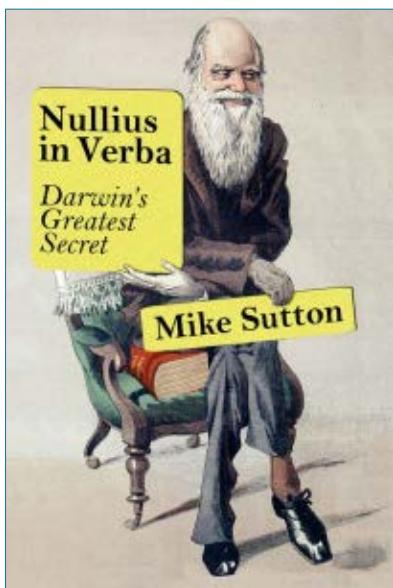


Figure 1. Sutton's *Nullius in Verba*

His letter was published in the 7 April edition.

“This discovery recently published as ‘the results of 20 years’ investigation and reflection’ by Mr. Darwin turns out to be what I published very fully and brought to apply practically to forestry in my work ‘Naval Timber and Arboriculture’, published as far back as January 1, 1831.”¹⁴

Darwin responded on 13 April, acknowledging Matthew’s priority in publication:

“I freely acknowledge that Mr. Matthew has anticipated by many years the explanation which I have offered of the origin of species, under the name of natural selection. I think that no one will feel surprised that neither I, nor apparently any other naturalist, had heard of Mr. Matthew’s views, considering how briefly they are given, and that they appeared in the appendix to a work on Naval Timber and Arboriculture. I can do no more than offer my apologies to Mr. Matthew for my entire ignorance of his publication. If another edition of my work is called for, I will insert a notice to the foregoing effect.”¹⁵

Darwin offered to add a comment to Patrick Matthew in a subsequent edition, and he later referenced Matthew’s prior work in the 3rd edition of *Origin*, even quoting another letter from Matthew. While Sutton focusses on the question of plagiarism from these passages, one may see a hint of sarcasm and irony in Matthew’s comment, which Darwin published approvingly in his own defence—maybe it was a case of Matthew ‘damning with faint praise’. Matthew had claimed his observations were axiomatic, ‘a self-evident fact’, whereas Darwin had to work it out slowly and carefully.

“Unfortunately the view was given by Mr. Matthew very briefly in scattered passages in an Appendix to a work on a different subject, so that it remained unnoticed until Mr. Matthew himself drew attention to it in the ‘*Gardener’s Chronicle*,’ on April 7th, 1860. … To me the conception of this law of Nature came intuitively as a self-evident fact, almost without an effort of concentrated thought. Mr. Darwin here seems to have more merit in the discovery than I have had; to me it did not appear a discovery. He seems to have worked it out by inductive reason, slowly and with due caution to have made his way synthetically from fact to fact onwards; while with me it was by a general glance at the scheme of Nature that I estimated this select production of species as an *à priori* recognisable fact—an axiom requiring only to be pointed out to be admitted by unprejudiced minds of sufficient grasp.”¹⁶

After this correspondence in the *Gazette*, Darwin wrote to Lyell to reaffirm his innocence of plagiarism on the grounds of its obscurity:

“… some few passages are rather obscure but it, is certainly, I think, a complete but not developed anticipation! Anyhow one may be excused in not having discovered the fact in a work on ‘Naval Timber’.”¹⁷

It is not entirely clear why Darwin would seek to justify himself to Lyell,

bearing in mind their close connection and Lyell’s sympathy and knowledge of Darwin’s plans for around 20 years.¹⁸

Matthew’s work had been cited by Darwin’s friends

Chapter 3 represents the bulk of the book, and the most relevant part. Sutton identifies those who had read Matthew’s work, *On Naval Timber…*, prior to 1858, and who had replicated phrases from that work in their own writing. He calls this ‘First to be Second (F2B2)’. Then he identifies those on that list who were close to Darwin.

Sutton points out that in fact Matthew’s work had been cited and reviewed by many of Darwin’s friends and associates, including in thirty publications, and some publications that Darwin himself had read (pp. 35–36). From this list are eight people, some anonymous, but the list includes John Loudon, who reviewed NTA in 1832, Adam Black, Matthew’s publisher, and Prideaux John Selby. This suggests Darwin’s appeal to ignorance in comments to the *Gardiner’s Chronicle* was at best in error, at worst deliberate fraud to pass off other’s ideas as his own.² Sutton asserts that Darwin’s claim of ignorance does not stand up to scrutiny, and that, contrary to Darwin, Matthew’s argument had appeared throughout his book and not just in the appendix (pp. 213–223).

Another claim of Sutton is that Matthew was the first to utilize a phrase “the Natural Process of Selection”, which clearly is very similar to the one Darwin later made his own. Sutton suggests that Darwin deliberately changed this to the ‘Process of Natural Selection’ (pp. 37–47), commenting elsewhere: “Darwin realised he had no choice but to use the same words so he called it the Process of Natural Selection. He shuffled the words and hoped nobody would notice.”²

Emma Darwin inadvertently made an admission in a letter to Patrick Matthew; a letter written by her because Charles was too ill to write. Emma wrote: “He is more faithful to your own

original child than you are yourself" (pp. 50–51, 159).¹⁹ This suggests an acknowledgment of priority to Matthew, although, in fairness to Darwin, he had already acknowledged that in the 1861 edition.

Ostracism and censorship

Sutton points out that there has been determined activity to censor information about Matthew's priority in subsequent years, even to the present day. This is borne out by the fact that so few people have heard of Matthew's work in present times. Darwin has become a sort of idol for naturalism, and even Wallace's contribution has become a footnote.²⁰ Sutton points out that Wikipedia continues to try and bury the evidence, although it may be acknowledged that the platform is wide open to abuse from anonymous or self-regulated sources.

Sutton discusses the campaign to discredit and ostracize Matthew in chapter 4. Lyell appears as a figure who worked closely with Darwin and Wallace and had reason to discredit Matthew, who appears to have been a Christian Chartist. (The Chartists campaigned for better rights for the poor against the nobility.) His catastrophism was evidently at odds with Lyell's uniformitarian arguments. Matthew's view of natural selection and speciation was also in the context of intelligent design. In 1867, Matthew was prevented from speaking at a meeting of the British Association for the Advancement of Science in Dundee. Although Matthew had prior claim to the theory, his paper was ordered last in the proceedings, which meant the meeting ran out of time, thus silencing him (pp. 102–105).

In chapter 5 Sutton discusses earlier attempts to get to the bottom of Darwin's plagiarism, and notes the difficulty encountered with not having the ability to search large data bases; for example, in works by Dempster that too readily accepted Darwin's excuses (p.107).¹¹ Sutton also shows that although Darwin claimed in the 3rd edition of *Origin of Species* that he

was "not familiar" with Buffon's work, there is ample evidence from the online *Darwin Correspondence Project* that he was well acquainted with the works (pp. 114–116).

In chapter 6, Sutton comments that the work outlined in his previous book had experienced fierce resistance from the Darwin-supporting establishment, what he called the 'Darwin Industry' (p. 107). In this chapter, *Beyond possible coincidence?*, he responds in more depth to some of those criticisms.

Summary

There is a lot of detail that readers may find difficult to wade through in this book, and more detail than can be given in this review, although it is useful for those wishing to conduct further research. We welcome the publication of this new book by Mike Sutton regarding Patrick Matthew's prior claim to natural selection, as it highlights further some of the machinations of Darwin and his inner circle of friends. We can only speculate on the motives, but Sutton suggests it is related to Lyell's campaign to reinforce his belief in slow and gradual processes in geology, and similar regarding Darwin's evolution. Matthew had believed in catastrophism and occasional revolutions in biological change. Matthew's commitment to natural theology and intelligent design were also an anathema to those who wished to pursue science without any reference to God. Evidence that Darwin's friends worked to isolate Matthew as a central character in the evolution narrative is also telling; as also is the ongoing campaign to silence and discredit those who question the 'sacredness' of Darwin in the present day. This will resonate with creation scientists who have struggled with their careers and studies for daring to question the narrative of evolution.

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The importance of being Adam

Adam, Where Are You? (And Why This Matters): A theological evaluation of the evolutionist hermeneutic

Willem J. Ouweeneel

Paideia Press, Jordan Station, ON, Canada, 2018

Ting Wang

Willem Ouweeneel states that “the essence of this book can be summarized very simply: if we believe human evolution, can we still retain the biblical message of Genesis 1–3? I (and many others) say: No” (p. xxv).

Ouweeneel supports his unequivocal ‘no’ with an analysis of numerous deleterious theological consequences that result from attempting to harmonize Genesis 1–3 with general evolutionary theory. As Ouweeneel puts it, “We read Genesis 1–3 either through Jesus’ and Paul’s glasses or through Darwin’s glasses” (p. 22), and if we “accept the assertion of certain so-called scientists and allow them to govern our interpretation of Genesis 1–3, … the result will be that we will lose … the gospel itself” (p. 32). In Ouweeneel’s view, the choice is between either revelation or evolution (p. 32), and he spends the bulk of the book categorizing various exegetical and theological implications of jettisoning the historical Adam.

Problems with the general theory of evolution

Ouweeneel possesses an impressive array of academic credentials including doctorates in biology, philosophy and systematic theology. From a biological perspective, Ouweeneel asserts that

“With the knowledge that we now have of biological processes and of

the fossil record, it is impossible for me to believe in general evolution (i.e. evolution from the first living cells to human beings)” (p. xxiii).

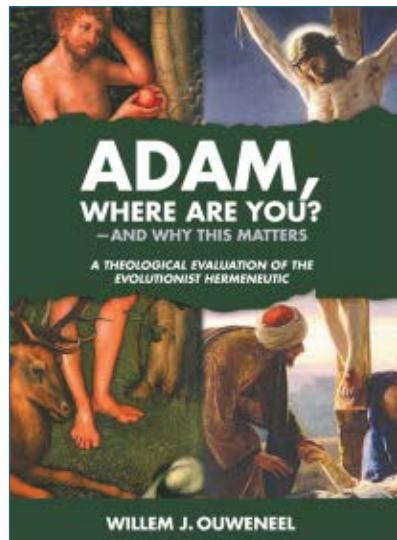
He then briefly touches upon several scientific problems with the general theory of evolution, a discussion that may provide a helpful summary for many readers. For instance, Ouweeneel writes that

“The point is that millions of *variations* themselves do not, and cannot, produce *innovation*, the supposed mechanism of accumulation of irreparable, advantageous, inheritable, code-expanding mutations of the DNA [emphasis in original]” (p. 37).

Ouweeneel notes that the natural processes supposedly responsible for abiogenesis (chemical evolution) “induced by putting simple substances into the radiation of the sun, or in the rain, wind, or lightning, are processes of decay” (p. 37), and that so-called ‘micro-evolution,’ which occurred perhaps most famously in the change of the beaks of Darwin’s finches, is “nothing other than biological *variation* [emphasis in original]” (p. 39), involving “the mechanism of gene regulation and the recombination of gene variants and selection” (p. 39). In addition, neither the fossil record nor modern genome biology supports the common ancestry of dogs and cats, and it should be a “problem to the evolutionists that everything seems to be changing in the evolutionary process” except the unchanging natural laws of uniformitarianism (p. 44). Ouweeneel consistently defines his scientific and theological terminology throughout the book, a feature that helps to clarify arguments for his readers.

Trust the science?

To those who assert that evolution has been incontrovertibly verified, Ouweeneel notes that Karl Popper points out that science is undergirded by an inductive process which, by definition,



can never be conclusive. To my mind this is one of the most compelling logical reasons why ‘trust the science’ is not a foundational principle but is rather more akin to ‘shifting sands.’ I am currently writing from sunny California which remains under a public ‘pandemic’ policy of ‘trust the science’, resulting in myriad, contradictory and sometimes seemingly illogical changes. Inductive processes are innately susceptible to the next data point or perception which may throw the entire hypothesis into disarray. Nonetheless, many seem to view inductive science as an authoritative body of knowledge with which Scripture must be ‘harmonized’.

For instance, “BioLogos invites the church and the world to see the harmony between science and biblical faith as we present an evolutionary understanding of God’s creation” (p. 27), and has been quite cleverly depicted as “helping fundamentalists evolve” (p. 27). BioLogos was founded by Francis S. Collins, who incidentally has also been involved in shaping the ‘trust the science’ pandemic response in the United States. Several well-known theologians such as John Walton and Tremper Longman III are on BioLogos’ advisory board, and the group has been highly influential in shaping various evolutionary understandings of creation for the broader church.

Scripture is authoritative over science

In contrast, Ouweneel writes that “if the historical Adam and the historical Fall (both in the biblical sense) are scientifically impossible, then so too are not only Joshua’s lengthened day but also the resurrection of Jesus” (p. 103). I think that this is a powerful argument for subordinating science to Scripture. The Resurrection of Jesus from the dead is essential to the Christian faith and the Christian Gospel and yet is a revivification that would likely be deemed absolutely impossible by the majority of scientists. Those who view Scripture as authoritative, then, should not fear if someone objects that the creation events described in Genesis are inconceivable from a scientific perspective.

Ouweneel asserts that “there is no middle path: the choice is evolution or revelation” (p. 32), a position echoing that of evolutionist Stephen Jay Gould, who asserted that “evolution substituted a naturalistic explanation of cold comfort for our former conviction that a benevolent deity fashioned us directly in his own image” (p. 71). Regarding the theological impact of reading the Genesis account of creation through a naturalistic lens, insight may come from a perhaps unlikely source. Atheist Richard Bozarth writes:

“... it becomes clear now that the whole justification of Jesus’ life and death is predicated on the existence of Adam and the fruit he and Eve ate. Without the original sin, who needs to be redeemed? Without Adam’s fall into a life of constant sin terminated by death, what purpose is there to Christianity? None. What all this means is that Christianity cannot lose the Genesis account of creation. ... the battle must be waged for Christianity is fighting for its very life” (p. 19).

Bozarth’s perspective is incisive (although Christianity manifests purposes, such as God’s glory, far beyond Adam’s fall into sin), and Ouweneel

concurs that “If we lose the biblical Adam, we lose the biblical Christ” (p. 296). In other words, the historical facts about the first Adam axiomatically undergird the historical facts about the Second Adam.

Evolutionary theology and the New Testament view of Genesis

Ouweneel organizes the analyses of the theological consequences of an evolutionary view of creation into several sections including biblical anthropology (who is man?), the trees and the serpent, the significance of the Fall, and original sin. He asserts, for instance, that if there is no actual serpent, the promise of Genesis 3:15 (a blessing amid the Curse which some have called the ‘protoevangelium’ or first Gospel promise) loses its sting. The upshot is that if we lose the details of Genesis 1–3 this inescapably erodes the theological architecture of the rest of Scripture. Ouweneel laments the “agonizing tension of the church’s double-commitment” (to modern science and to Christian teaching) (p. 273) and asserts that such cannot be supported by rigorous exegetical theology, noting that “this has been one of the besetting sins of theologians: they often overemphasize systematic theology at the expense of biblical exegesis” (p. 247).

Ouweneel devotes the final chapter of the book to “The New Testament on Genesis 1–3” and the exegesis in this chapter is so compelling that it by itself is worth more than the proverbial ‘price of admission’. Scholars who “struggle with the notion of the historical Adam” (p. 314) sometimes attempt to curvette around Paul’s view of Adam as a historical being by portraying Paul as an archaic theologian whose views were steeped in the opaque mists of antiquity, but Ouweneel points out that Jesus himself asserted that Adam, Cain, Abel, and Noah were historical people. Overall, as Greg Haslem notes,

“The NT endorses the accuracy of Genesis directly and indirectly over 200 times, and cites Genesis 1–11 107 times. Jesus refers to

Genesis twenty-five times to reinforce important doctrines [emphases in original]” (p. 330).

These numbers are indeed compelling. Those scholars who wish to view Genesis 1–3 through an evolutionary lens must grapple—fruitlessly, in Ouweneel’s view—with the theological consequences that reverberate through the rest of Scripture including the exegesis of the words of Christ and an understanding of the eternal Gospel (Revelation 14:6).

Conclusion

I have some theological differences with the book, but these are not central to Ouweneel’s overall analysis of the corrosive consequences of reading Scripture through an evolutionary lens. For instance, Ouweneel does not subscribe to “the Reformed idea that the ‘righteousness of Christ’, that is, his Torah-obedience, has supposedly been imputed to (i.e. transferred to the account of) believers” (p. 290), and asserts that “nothing of what Adam committed is imputed” to people. I believe that ‘double-imputation’—righteousness to believers and sin to Christ (in both cases as a status and not ontology, for Jesus never actually becomes a sinner and believers never actually become perfectly righteous in this lifetime)—to be a foundational theological concept, but nonetheless these matters do not detract from Ouweneel’s insightful and comprehensive analysis of the biblical text with regard to the ongoing tension between evolution and revelation. Ouweneel ends his powerful book on a hopeful—indeed pastoral—note, encouraging his readers to long for the return of the Second Adam, who so magnificently reverses the Curse assigned to the first.

In the Beginning: welcome affirmation of creation

In the Beginning: Listening to Genesis 1 and 2

Cornelis van Dam

Reformation Heritage Books, Grand Rapids, MI, 2021

Benno A. Zuidam

Reading the creation account of Genesis 1 and 2 as history is not only justified but necessary. The Hebrew text claims to be an accurate account of the origin of the earth and the human race, using the language of human experience. In the swelling tide of theistic evolution and agnosticism, Dr Cornelis van Dam's book *In the Beginning* is a welcome affirmation of the historicity of the biblical creation account.

Cornelis van Dam was professor of Old Testament studies at the Canadian Reformed Theological Seminary in Hamilton, Ontario (1984–2011). In this role he laid the basis for this present book (How Shall We Read Genesis 1? *Mid-America J. Theology* 6:19–32, 1990). Van Dam is concerned with some of the present trends in evangelical scholarship and used his retirement years to reflect on the first chapters of Genesis. It is perhaps indicative that most scholars who endorsed this book have retired from active academic life.

Although his treatment of Genesis 2 appears to be quite limited (pp. 249–277)—most of the book deals with Genesis 1—van Dam raises important questions, like the geographical location of Eden, and considers the arguments for Eden as a temple. He also discusses the creation of angels separately.

Reformed perspective

It is helpful to be aware of the Presbyterian & Reformed denominational setting of the author. Van Dam writes from a Dutch reformed theological perspective in the tradition of Abraham Kuyper (and subsequently Klaas Schilder). Kuyper separated from the Dutch Reformed Church in 1886 to form the Reformed Churches of the Netherlands. A conflict within this denomination about presumed regeneration as the basis for infant baptism (1944/45) led to the formation of a federated reformed church in the Netherlands, of which the Canadian Reformed Churches are the migrant version.

This explains why this book uses names like Schilder, Herman Bavinck, and Ridderbosch as if these men should be naturally familiar to all readers. They certainly are to van Dam, who also pays attention to the Princeton tradition and similarly minded American theologians in Presbyterian & Reformed circles. This, in part, explains the thetic approach of *In the Beginning*. At times this causes a lack of interaction with primary and secondary sources, and conflicting theories, unless these are contemporary and English speaking, like John Walton or John Collins. More interaction with original sources and a careful interaction with opposing views would strengthen van Dam's case, if only to avoid additional questions. Nonetheless, van Dam makes out a strong case for a traditional interpretation of Genesis from the biblical text. Otherwise, the main alternative theories are discussed.

CORNELIS VAN DAM



In the
BEGINNING
Listening to Genesis 1 and 2

Gap theory

An illustration of this perceived lack of interaction with the arguments of opponents, is van Dam's chapter on the 'gap theory'. It is quite helpful in linking this with the Scofield Bible and in describing some of the origins of the gap theory in evangelical thinking. However, it subsequently presents an impressive line-up of 19th and 20th century Dutch theologians (including creationist scholars like Willem Velema and Jan van Genderen) who all adhered to the view that the first verses of Genesis reflect two separate creations. As a reader, one expects the author to carefully weigh the arguments of these godly men. For this the interested reader waits in vain. Van Dam merely mentions and dismisses, while presenting and maintaining, his own view.

In the meantime, the reader should be satisfied with the knowledge that François Turretin (or Turrettini), a Calvinist who died in 1687, specifically rejected the idea that verses 1 and 2 refer to a time before the six days of creation (figure 1). This simply isn't good enough for most. Many readers would not have heard of this learned Genevan or attach any authority to his

views. Even if van Dam was justified in proposing Turretin as an authority for today's problems, it would have been helpful if Turretin's good reasons for his position were shared with the reader.

Lack of interaction

Interaction with opposing views is also absent or superficial when van Dam deals with the long list of theologians in the neo-reformed tradition who proposed two separate creation moments in Genesis. For instance, van Dam is probably correct in asserting that the Sabbath commandment in Exodus 20:11—"for in six days God made the heavens and the earth"—is probably the best argument against the notion of a first or earlier creation in Genesis 1:1–2. However, the author does not interact with Bavinck's arguments for understanding the fourth commandments as building on Genesis 1:3–31 rather than 1:1–2. Van Dam is quick to dismiss: "But such reasoning is arbitrary and has no basis in Scripture" (p. 104). Well now, tell us why? The author perhaps genuinely feels he does so, as he continues: "No distinction is made between a first creation (Gen. 1:1–2) and a separate second creation comprised of the six-day period." But this is merely a form of circular reasoning and a repetition of his view.

Perhaps the best common-sense argument against the gap theory is borrowed from John Frame; it makes no sense to science whatsoever. Introducing a time gap before Genesis 1:3 creates more problems with science than it solves. The proposition that the earth existed without light or heavenly bodies is something very few scientists would contemplate seriously. So, in the end, the gap theory is dealt with by van Dam, but not on the basis of carefully weighing arguments from the source materials. This thetic style perhaps fails to do justice to opponents, but also affects the methodology, particularly in

the strength of its conclusions; because van Dam has not really refuted opposing views but merely dismissed them from his own paradigm. His Reformed and Presbyterian readership will no doubt be satisfied; however, he fails to build a positive basis for his final conclusions that would persuade readers from different paradigms or backgrounds.

In the case of the gap theory and a double creation, one would have liked to see positive reasons and conclusive arguments from the text of Genesis, and the history of reception of the text in its initial context, plus supporting data from early Judaism and Christianity. A word of explanation as to why this long list of mostly Bible-believing scholars

from van Dam's religious tradition had it all wrong, despite being firm believers in the historicity of Genesis, would have enhanced his argument.

Methodology

This lack of specific interaction also reflects in, at times, vague and general conclusions. For instance: "There is no convincing evidence of an indeterminate time gap within the first verses of Genesis 1" (p. 105). This is an ambiguous statement; rather a series of caveats than a firm statement. There may be lots of evidence, but for van Dam it is not convincing. There may well be a time gap, but not an indeterminate one, etc. This is hardly compelling. Also, readers have a right to wonder what practical difference there is between the position of van Dam and that of the esteemed litany of reformed theologians that he disagrees with. Not only is his conclusion inconclusive, but the careful reader wonders about the relevance of van Dam's stance.

Had the author opted for a different method, the results should have been more specific and helpful for the development of independent thought. Van Dam could have pointed to the rich exegetical tradition of the church of all ages, where the idea of two creations within Genesis 1 was unheard of. Not as a dismissive generalization, but illustrating with specific examples from the Church Fathers or from Hebrew and Greek scholars of renown who insist that the text in Genesis teaches one creation. The author could have asked the question as to why this 'gap' was introduced only after general science had developed and insisted on a geological worldview with long ages; not merely by inference but proving from the writings of his opponents that a foreign element was introduced in the exegesis of the text and why. The history of exegesis and church history have much to offer in this regard.

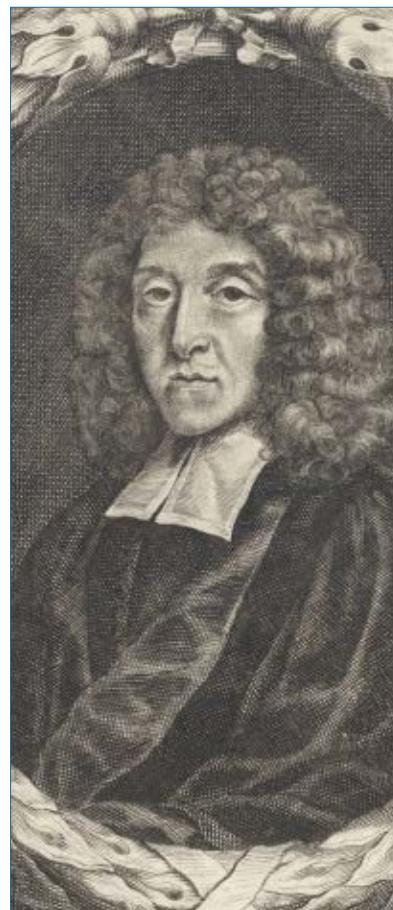


Figure 1. Calvinist Francois Turretin (1623–1687) specifically rejected the idea that verses 1 and 2 of Genesis refer to a time before the six days of creation.

Augustine

Van Dam's book does not fully employ these treasures. It easily switches from the Bible and van Dam's own view to a little Augustine, some Calvin, and then mainly the Dutch neo-reformed tradition. The early church is largely overlooked, and, when it is discussed, it is dismissed, as in the case of Augustine's view on a single creation of everything together and subsequently worked out in creation days. Traditional Christianity has always allowed Augustine's view on the days in Genesis—not because the Church necessarily agreed—most fathers did not—but because she weighed his arguments. For all practical intents and purposes, Augustine believed in an instantaneous historical creation and a young earth on the basis of God's revelation. His anthropomorphic views of the six days were quite different from those that are ventilated by contemporary scholarship.

In dismissing Augustine's view, van Dam points to the *Wisdom of Jesus Sirach* (18:1) as the source of Augustine's position that there was one moment of creation. ΣΟΦΙΑ ΣΙΠΑΧ 18.1 Ο ζῶν εἰς τὸν αἰῶνα ἔκτισεν τὰ πάντα κοινῇ. (He who lives in eternity has created all things together). Augustine's Latin version similarly reads: *Qui vivit in aeternum creavit omnia simul*. Van Dam suggests that *simul* is a wrong translation for *κοινῇ* and prefers the rendition of the New English Translation Septuagint (Oxford University Press 2009), that God: "created everything in common". This closely follows the Common English Bible: "The one who lives forever created everything in a common fashion."

But this is questionable. The Greek *κοινῇ* refers to the common time of creation, everything was made together, part of the same creation process; just like Latin *simul* does. For this reason, the NRSV translates: "He who lives forever created the whole universe."

This is independently confirmed by a very different theological tradition in the Geneva Bible: "He that liveth forever, made all things together." The Geneva Bible even provides a specific reference to Gen 1:1, so that there is no room for misunderstanding. This notion of togetherness is also reflected by the Dutch *Statenvertaling*: "DIE in eeuwigheid leeft, heeft alle dingen in het gemeen geschapen." Greek commentators in the Byzantine tradition use words like 'without exception' (*ανεξαιρέτως*) or 'universal' (*γενικῶς*) to explain what is meant by *κοινῇ*.

In sum, Augustine's view is not the result of poor linguistic skills, but of interpretation. Jesus Sirach makes perfect sense, even from a literal six-day perspective, as a general reference to God making everything together and complementary. What van Dam should have discussed is whether Augustine's turning of this into a momentary occasion is the best interpretation of Genesis or rather a consequence of imported neo-Platonic constructs. Or he could, perhaps, have questioned whether Augustine should have used a deuterocanonical book as basis for his theories, if he did.

In other words, the Latin text of Jesus Sirach is fine.

Henry Morris

One final critical remark about what I consider to be generally a helpful and timely book. Dr van Dam rather forcefully dismisses Dr Henry Morris and an earlier generation of creationist scholars who tended to read scientific data in Bible passages where theologians could not detect any (pp. 30–35). He also finds it embarrassing that Morris's essay on the Bible as a textbook of science has not (yet) been removed from the website of the Institute for Creation Research. How desirable is this?

Is it really so embarrassing to display what are these days recognized as fallible attempts that were nonetheless

carried by an overall balanced trust in the God who exists and speaks? Henry Morris probably read too much into the Bible, perhaps somewhat carried away by his discovery that God's Word was reliable in all respects, and not merely a spiritual book for theologians. This is no excuse, but it does provide a context to his words. Also, many of the things that Morris asserted were true and biblical. Even if the specific text he referred to did not literally say so, more often than not he expressed a truth or a possibility that was evidenced generally in Scripture or in nature (*Belgic Confession* article 2). Morris then asked the question: shouldn't we consider this? God upholding the universe may have energy implications, certainly of some sort. The early church would have considered this a valid form of allegory.

And, finally, theologians have been wrong before. There are very few creationists among the scholars at leading seminaries. Even the endorsements of *In the Beginning* are mostly from retired professors at less well-known institutions. Many professional theologians have been affected by a post-Enlightenment separation between the things of God and the material world. Henry Morris, even in his fallible attempts, was a light bearer of an integrated attempt. Hopefully, his controversial article about the Bible as textbook for science will remain available on the internet, as a reminder of a great and humble man, who was sometimes wrong, as are most good scientists.

Documenting the obvious

Darwinian Racism: How Darwin influenced Hitler, Nazism, and white nationalism

Richard Weikart

Discovery Institute Press, Seattle, WA, 2022

Jerry Bergman

One of the most condemned parts of the film *Expelled: No intelligence allowed* was the interview with Professor Weikart on the influence of Darwinism on Hitler and Nazism. Typical was the charge that the movie *Expelled* attempted to ‘link evolution to the Holocaust’; an attempt that was called ‘insidious’. Science historian Susan Spath commented:

“The implication that Darwin led to Nazism and the Holocaust is an irresponsible misrepresentation of a terrible history. Hitler abused many things, including science, and *Expelled* is wrong to shift blame off his [Hitler’s] shoulders and onto evolution.”¹

Scores of other examples exist. The Anti-Defamation League wrote, in a press release, “Darwin and evolutionary theory cannot explain Hitler’s genocidal madness. Using the Holocaust in order to tarnish those who promote the theory of evolution is outrageous ...”²

Almost all of the 63 Amazon reviews of my book documenting the connection between Darwin and Hitler were very favourable, but one reviewer opined:

“The author of the book is a noted creationist and anti-evolutionist. He is basically trying to slam Darwin and Evolution by tying it to ... the Nazis. ... Darwin never was a ‘social Darwinist’ and never even wrote or uttered the phrase ‘survival of the fittest’.”³

In fact, Weikart documents that Hitler used the phrase ‘survival of the fittest’ so often that, in one study of

“... the ideology of Nazis, neo-Nazis, and white nationalists, we find that Darwinism—the view that species have evolved over eons of time through the process of natural selection—plays a fundamental role, shaping their views about race and society” (p. 11).

Darwinian selection at the heart of Nazi theory

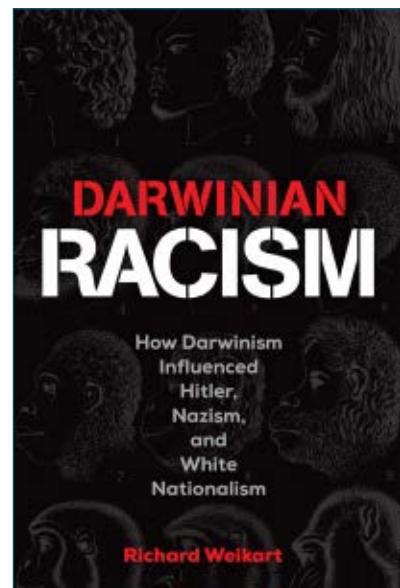
Darwinian natural selection was at the heart of the Nazi theory; namely, the Nazis

“... believed that the Nordic race had become superior because harsh climatic conditions in north-central Europe during the ice ages had sharpened the struggle for existence, causing the weak to perish and leaving only the most vigorous” (p. 15).

Weikart backs up this survival of the fittest claim with scores of quotes directly from Hitler’s speeches and writings. Furthermore, Weikart documents the influence of both Hitler’s evolutionary associates and the books Hitler owned and read that influenced him to accept Darwinism (pp. 36–40). Other books, such as Zitzer’s 778-page tome, go into more detail than Weikart’s book, but Weikart provides an excellent summary of the strong connection between Darwin and racism.⁴

Weikart’s academic qualifications

Weikart completed his Ph.D. in modern European history at the University of Iowa for which he received the biennial History of Human Sciences Prize for the best dissertation in his field. Weikart’s revised dissertation,



Socialist Darwinism: Evolution in German Socialist Thought, was published in 1999. He then spent the rest of his academic career documenting the important influence of Darwinism in supporting both Nazism and the Holocaust, publishing several more books and articles to defend his thesis. To do his research, he mastered the German language and reviewed scores of German language textbooks, book chapters, and scholarly articles published both before and during WWII.

Darwin was a racist

Racism was not an incidental part of Darwin’s evolutionary theory; rather, Darwin considered racial inequality crucial evidence for his theory. Darwin also often expressed extreme racist conclusions in his writings. One common example is “the civilized races ... are now everywhere extending their range, so as to take the place of the lower races [emphasis added]”, which Darwin believed would eventually lose out in the survival-of-the-fittest struggle.⁵ Weikart located many other examples in Darwin’s writings, which the Nazis exploited to support their racist agenda.

One example is *Rassenkunde des deutschen Volkes* (Racial Science of

the German People), which stated that Darwin was “one of the most important men who ... explained that humans have evolved from more primitive human ancestors such as *pithecanthropus* and Neanderthals” (p. 38). Neanderthals were, for decades, pictured as primitive brutes that became extinct in the survival-of-the-fittest competition with modern humans. The implications of racism in human evolution were explicit in another German textbook, which “emphasized racial inequality and the dangers of racial mixing” (p. 39). The fact is, for “Hitler, the Darwinian struggle for existence between humans, especially the competition between the races, was *central* to his worldview and policies [emphasis added]” (p. 40). Furthermore, the “overriding long-term goal behind all Nazi policies was to promote evolutionary progress”, which enabled the Aryans, as the superior race, to “triumph in the struggle for existence against other races” (p. 79).

To achieve this Darwinian goal, in 1933 “Hitler introduced a sweeping eugenic program, which resulted in the compulsory sterilization of 350,000 to 400,000 mentally and physically disabled Germans”, leading to the Holocaust, which murdered over 12 million Jews and Slavs (p. 79). The degree of high-level academic cooperation with the Nazi program was illustrated by seminars given by the Nazi Interior Ministry, which oriented 120 psychologists to the Nazi eugenic programs (p. 88). This conference stressed,

“Nature is engaged in a biological struggle for existence! ... Every species and race is purified and improved again and again through a process of selection ... As a result of biological selection the inferior individual perishes Darwin called this elimination ... natural selection” (p. 88).

Numerous similar seminars given by prominent academics teaching at leading German universities also attracted large audiences.

Weikart’s conclusions about the major influence of Darwin on racism, Nazism, and the Holocaust are not unique among scholars. Among those Weikart lists are Jückel Elberhard’s *Hitler’s Worldview: A blueprint for power*,⁶ which details how racism, influenced by social Darwinism, was at the heart of Hitler’s worldview. Furthermore, Darwinism was at the heart of both Nazism and the Holocaust.

Darwin’s militant racism was acknowledged by Dr Agustín Fuentes, a primatologist and biological anthropologist at Princeton University, in an article published in *Science*.⁷ Fuentes wrote that Darwin’s racist “assertions were dismally, and dangerously wrong” and his *Descent of Man* is a book “not to venerate” as is common among many evolutionists today. Fuentes writes that,

“‘Descent’ is often problematic, prejudiced, and injurious. Darwin thought he was relying on data, objectivity, and scientific thinking in describing human evolutionary outcomes. But for much of the book, he was not. ‘Descent’, ... offers a racist and sexist view of humanity.”⁷

Fuentes concludes that Darwin “... asserted evolutionary differences between races. He went beyond simple racial rankings, offering justification of empire and colonialism, and genocide, through ‘survival of the fittest’ Darwin’s racist and sexist beliefs, echoing the views of scientific colleagues and his society, were powerful mediators of his perception of reality.”⁷

Documenting the connection between Darwinism and the Holocaust

Weikart’s book is one of the most well-documented tomes that rely on original German language sources to document the direct connection between Darwinism and the Holocaust. The author, one of the most qualified historians alive on this topic, relied on Reich educational publications,

Nazi propaganda, textbooks used in German schools, and the writings of prominent German biologists and anthropologists that propagated the racism that led to the Holocaust. Examples include Professor Fritz Lenz (Eugenics, University of Munich), Nordic eugenicist Hans Günther, and Darwin disciple Ernst Haeckel.

Scientists’ racism exploited by white supremacists

The fact is, “Racists, sexists, and white supremacists, some of them academics, use concepts and statements ‘validated’ by their presence in ‘Descent’ as support for erroneous beliefs, and the public accepts much of it uncritically.”⁷ An example is the Ku Klux Klan often using quotes and claims from older, pre-1940, scientific literature to justify its Negro inferiority claims (figure 1).

In both the first and final chapters, Weikart documents how both white nationalists and neo-Nazis still rely heavily on Darwinism to buttress their racist ideology. He documents the fact that *a major support for their beliefs is Darwinism*—a conclusion determined by reviewing the writings of the most prominent racists today. One of the best-known examples is the 1999 Eric Harris and Dylan Klebold murder of 13 students, wounding 24, on Hitler’s birthdate (20 April), wearing shirts proclaiming Darwin’s ‘Natural Selection’ phrase. Attempts to justify the slaughter by claiming both boys were maladjusted do not negate the obvious influence of Darwinism in the actions of both boys. As Weikart correctly observes, Darwinism was an important part, if not a central element, of Nazism, neo-Nazism, and white nationalism (p. 11).

The former KKK leader, David Duke, once headed the largest white supremacist organization in the world. His influence can be gauged by the fact that he was elected to serve in the State of Louisiana Congress. Duke was reared as a young-earth creationist who, in college, not only rejected

creation and accepted evolution, but also accepted racism. In his 778-page autobiography, Duke documented in detail the long history of racism in evolutionary literature. Duke's interest in evolution's support of the inferior-race belief was originally stirred by Professor Carleton Coon of Harvard. Coon was then a leading physical anthropologist and the president of the American Association of Physical Anthropologists. Duke devoured all of Coon's books, including the *Origin of the Races*, and became convinced that evolutionary science proved some races were superior to others.^{8,9} Darwin's writings were an especially important influence on racism because his ideas had a profound influence on the entire academic and scientific world. In fact, “*The Descent of Man*” is one of the most influential books in the history of human evolutionary science.⁷

Darwin's callousness toward those he regarded as less-evolved races was reflected in the words that he wrote to T.H. Huxley on 9 July 1857, namely “a scientific man ought to have no wishes, no affections—a mere heart of stone.”¹⁰ Indeed, the Holocaust is one of the best examples of an event carried out with a heart of stone.

Summary

Weikart used his impeccable qualifications to document, in detail, the fact that Darwin had a major influence in producing the lethal racism that developed after the biblical foundation of the equality of the ‘races’ was undermined by Darwinism. Now that the leading scientific journal, *Science*, has acknowledged Darwin's major contribution to the racism problem,

other journals may be more open to document this fact. Nonetheless, the name-calling from uninformed persons still speaks to a denial of this now well-documented reality. One review of Weikart's new book on Amazon stated that it

“... is a hit job on Darwin for the Discovery Institute; his religious employer. Dedicating [sic] to making Darwin the bad guy; thus making it easier to separate the uninformed from their tax \$’s so as to fund religious educations for America’s children. ... Darwin’s ideas ended this horrible chapter rather than starting it!”¹¹

This ‘review’ is an excellent example of irresponsible name-calling, a fact which is obvious to anyone who has read the book, or is somewhat informed about the subject.

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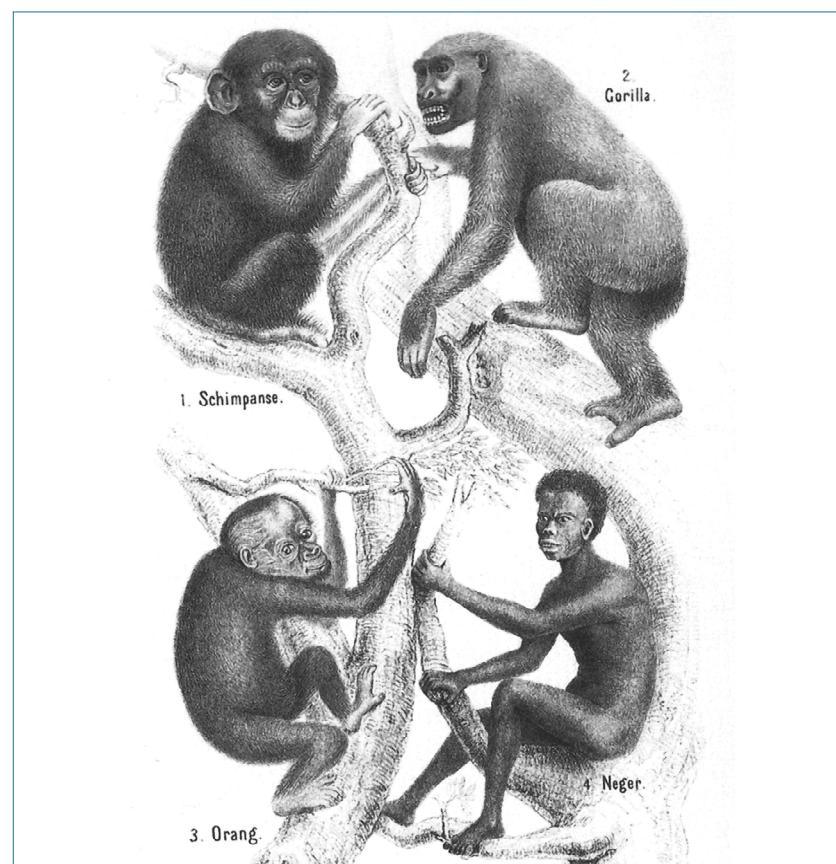


Figure 1. A frontispiece used in several of Ernst Haeckel's books, e.g. *The Evolution of Man*, German edition, 1874. Note the negro is placed in the tree with three apes, the orang, gorilla, and the chimpanzee.

Longwinded, sometimes interesting, and marred by evolutionary presuppositions

Is Atheism Dead?

Eric Metaxas

Salem Books, Washington D.C., 2021

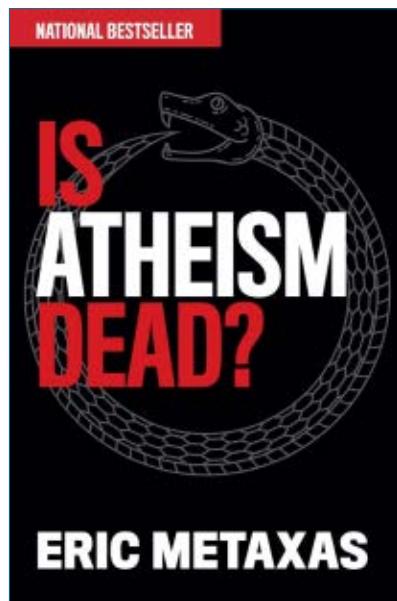
Gavin Cox

Eric Metaxas (born 1963) is an American Christian author, speaker, and conservative radio host. He has a broad influence—a number-one best selling author who has written for many major US news outlets. His latest book, *Is Atheism Dead?*, covers, for lay readers, five major themes, in 30 chapters plus a bibliography and short appendix. The list of endorsing figures on the dust jacket comprises ID and old-earth advocates, including Hugh Ross, giving away the position of Metaxas regarding issues of

cosmological origins.¹ The only reference to ‘creationist’ literature in the appendix is Hugh Ross and ID sources, but sadly no young-earth creationists (YECs)—against whom he demonstrates prejudice and woeful ignorance.

Starting off on the wrong foot

Influenced by Hugh Ross, Metaxas assumes big bang cosmology and its timeline from the outset (pp. 6, 41, 319). However, that ‘beginning’ is not in any sense the one taught in Genesis; neither is it friendly to Christianity as Metaxas believes. Before the big bang notion took hold, the universe was considered to be infinite; therefore infinite time was supposedly available for evolution to have achieved life. However, given just a finite amount of time, the laws of chemistry and physics constantly conspire against chemical evolution, as Dean Kenyon



recognized, even while believing, at the time, in evolution.² Adding billions of years (or even an infinite amount of time) just gives more time for dead chemicals to become even more dead.

Big bang—big bust

Metaxas believes the ‘big bang’ represents ultimate proof of God as creator, because it destroys the hypothesis of the eternal universe. However, scientifically, the big bang is a big bust,³ as many secular cosmogonists now realize.⁴ But Metaxas appears to be entirely ignorant of secular problems with the big bang, let alone biblical problems.

According to Metaxas, Hubble “saw something astonishing” no one else had—the universe expanding, and moving away from every point (pp. 13, 17). However, Hubble saw no such thing, he merely interpreted the stars’ red shifts as representing their speed. Hubble initially doubted that the expansion was an explanation of the data. Expansion (in the big bang sense) only later became the entrenched dogma.⁵

Image: European Space Agency / Wikimedia, CC BY-SA 4.0

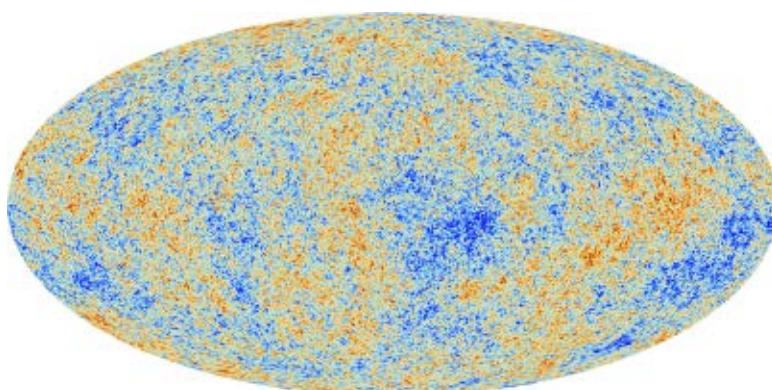


Figure 1. The Cosmic Microwave Background as seen from the Planck satellite

Metaxas believes the 2.7-K cosmic microwave background radiation (CMBR) is ‘proof’ of the big bang’s leftover heat (figure 1). However, this is an interpretation that led to the fatal ‘horizon problem’ of not enough time in the supposed 14.7-billion-year universe for the heat to equilibrate.⁶ But even if one assumes the big bang, the CMBR is not consistent with big bang cosmology and could represent something else altogether.⁷

Earth’s privileged position

Metaxas discusses essential conditions for life to exist on Earth, including its size, distance from the sun, and large planets in outer orbits protecting the earth by catching/deflecting asteroids. But this last idea has been challenged for some years, for example by planetary scientist Kevin Grazier.⁸

Earth’s moon, according to Metaxas, was created when a Mars-sized object hit the proto-Earth, and the resultant mass ejection created our moon—an idea fraught with problems.⁹ Metaxas describes all the variables that needed to be exact for this event to have occurred. So much so that he describes it as a ‘miracle’ (p. 47). But then why not accept the miracle of creation as outlined in Genesis 1:1–16?

Fine-tuned universe

Metaxas quotes Stephen Hawking (figure 2), who recognized improbable fine-tuning for the universe to exist:

“If the overall density of the universe were changed by even 0.000000000001 percent, no stars or galaxies could be formed. If the rate of expansion one second after the Big Bang had been smaller by even one part in a hundred thousand, million, million, the universe would have re-collapsed

before it reached its present size” (p. 56).

I accept Hawking’s first observation regarding the universe’s density, but not his second point, which presupposes big bang cosmology. Nevertheless, even hard-bitten atheist Hawking recognized the implications of such incredible odds:

“It would be very difficult to explain why the universe would have begun in just this way, except as the act of a God who intended to create beings like us” (p. 57).

As a result of such astonishing universal probabilities, Fred Hoyle, writing in the *Caltech alumni magazine*, suggested that a “super intellect has monkeyed with physics, as well as with chemistry and biology.”¹⁰

Supporting evolutionary presuppositions

Metaxas glibly states, “Life has been around for about four billion years” (p. 85). But what is life and

how did it arrive? Sadly, Metaxas doesn’t turn to Genesis 1 for answers. Neither does he even hint at the fundamental theological problem of placing death before the Fall. He rightly critiques the 1952 Miller–Urey experiment and how science ‘clung to the results’. In popular culture, the answer to ‘where the first life came from’, or at least its precursors, was ‘answered’ and everyone ‘moved on’. In reality, the Miller–Urey research was simply a revival of the antique notion of spontaneous generation.¹¹ Miller–Urey hasn’t been improved on. Rather, the problem has become compounded, because science has discovered how complex life is. For instance, a year after Miller–Urey, Watson and Crick discovered DNA’s elegant, complex double-helix structure (p. 97). More recently, Stephen Meyer calculated that an average protein of 150 amino acids in length would require a 1 in 10^{164} chance of forming. In practical terms, it could never happen even if we granted the secular timeframe of the universe (p. 98).

Biblical archaeology

Metaxas turns to the world of biblical archaeology to demonstrate the trustworthiness of Scripture. For me, this was a useful section outlining the development of biblical archaeology as a discipline. The following is a condensed summary of the artefacts he discusses.

The Hittite empire

In the 19th century, liberal theologians dismissed the Bible on account of the Hittites, who were not mentioned by any ancient historian. However, in 1880, Archibald Henry Sayce announced to the London meeting for the *Society of Biblical Archaeology* that mysterious hieroglyphs and ruins belonged to the Hittites of the Bible (p. 133).¹²

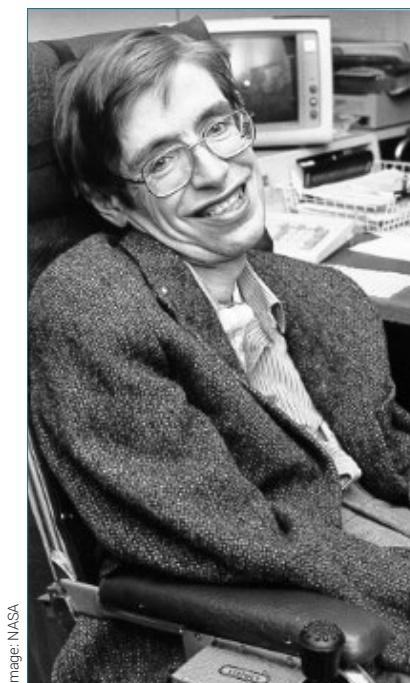


Figure 2. Stephen Hawking, Cambridge Professor of mathematics, openly espoused atheism his entire career.



Figure 3. The Mesha Stele, showing Ganneau's reconstruction from the 1870s

Shalmaneser III (858–824 BC) Black Obelisk

Sir Austin Henry Layard discovered the obelisk in 1846 in Mosul, Iraq. Two years later, Edward Hinks, an Irish clergyman and expert Assyriologist, read the names ‘Omri’ and ‘Jehu’ (2 Kings 9:5, 25) being the first extra-biblical proof of Jehu’s existence (p. 140–141).¹³

Moabite stone

The Mesha Stela (3 ft x 2 ft black obelisk)¹⁴ (figure 3) is inscribed with Canaanite paleo-Hebrew text from the 9th century BC. It was discovered by Frederick Augustus Klein in 1868 in the ancient city of Dhaban, in Bedouin territory. It bore stunning inscriptions corroborating II Kings 3, describing Mesha, the Moabite king, paying Omri, the Israelite king, with sheep and included the divine name *YHWH*. Unfortunately, for unknown reasons, the Bedouins destroyed the stele, but Klein purchased the pieces.

Using a Papier-mâché ‘squeeze’ Klein reconstructed the stone, along with its text. It was then housed in the London Museum to the delight of Victorian society (pp. 141–147).

Merneptah stele (19th-dynasty Pharaoh, 1,200 BC)

Discovered in Thebes, modern day Luxor, in 1896 by British Egyptologist William Flinders Petrie, the stele bore the first extra-biblical mention of Canaan and Israel thus far discovered.¹⁵ This pushed back the inscriptional evidence for Israel 300 years beyond the Moabite stone, thereby burying liberal thinking regarding Israel’s late formation (pp. 148–150).

Qumran (‘Dead Sea’) scrolls

The scrolls were accidentally discovered by a Bedouin boy in 1947. They contained writings from the first century BC. Most significantly, 37 of the OT’s 39 books were represented—essentially unchanged compared to the modern texts. These discoveries provided all the evidence necessary to forever bury liberal attacks—that the Bible had been ‘changed’ over the centuries to suit church narrative. Metaxas deftly states, “Never in human history has an observed absence of change so instantly and dramatically changed everything” (p. 156).

Qumran Isaiah scroll

The greatest Qumran treasure discovered dates to the 4th century BC. Only three centuries removed from Isaiah’s time and 26 centuries removed from modern times, the text remained virtually unchanged compared to text a thousand years younger. It was also a single scroll, contrary to liberal claims that the book of Isaiah had two or even three authors. This demonstrates the

painstaking accuracy of Jewish (and Christian) scribes who faithfully copied the Scriptures—and did not change them, as scurrilously charged by liberal skeptics.¹⁶

Hezekiah’s tunnel

In 1867, Charles Warren discovered ‘Warren’s Shaft’, suggesting a connecting tunnel was Hezekiah’s. In 1880 Conrad Schick, a German archaeologist, publicized a tunnel inscription accidentally discovered by a child. Oxford’s leading Assyriologist, Dr Archibald Sayce translated the paleo-Hebrew text describing activity of workmen, hurriedly completing Hezekiah’s tunnel and meeting half-way in accordance with 2 Kings 20:20 and 2 Chronicles 32:30 (pp. 169–171).¹⁷

Ketef Hinnom silver scrolls

In 1979, Gabriel Barkay, then professor of archaeology at Tel Aviv University, made an accidental discovery while excavating a Jerusalem cemetery. Thanks to an unruly child assisting, a chamber hidden beneath the floor was broken into, revealing 7th-century-BC treasures—including two minuscule silver scrolls bearing the name of *YHWH*. Later, infrared imaging revealed text inside the scrolls. Careful unwrapping revealed the priestly blessing of Numbers 6:22–24. In 2004, a Southern Californian University team concluded the text was Proto-Hebrew, dating from pre-exilic times, prior to the 586 BC destruction of Jerusalem—representing the oldest biblical text ever discovered.¹⁸

New Testament manuscripts

F.F. Bruce demonstrated the NT is the most reliable of all ancient documents.¹⁹ The reasons being—the short chronological distance between

the original document and its earliest copy, and the number of copies. Other historical Greek manuscripts²⁰ exist as a mere handful of copies, with gaps of 1,200–1,500 years between the historical events described and their earliest copies!

Furthermore, the level of accuracy achieved by the biblical copyists is demonstrated as virtually flawless. For instance, *John Rylands Papyrus 52* is a fragment of John’s Gospel, textually unchanged compared to our modern versions, but dated to AD 100–175, possibly within 30 years of the original.²¹

Corroborating NT evidences

In 1887 a Greek inscription (dated AD 47) found on the northern coast of Cyprus referred to a ‘proconsul Paulus’. Then, in Rome, a stone inscription (dated AD 54) was found referring to ‘L. Sergius Paulus’ as curator of the Tiber River—the very proconsul Sergius Paulus mentioned in Acts 13:7.

In 1905, a graduate student sifting through pottery shards from the Temple of Apollo, Delphi, discovered an inscription (dated AD Jan–Aug 52) belonging to Roman emperor Claudius referring to “Julius Gallio, my friend and proconsul”. This information directly corroborates the accuracy of Luke in Acts 18:12–17 and serves as an accurate chronological anchor for Paul’s journeys.

Recent Jerusalem discoveries

In 1871, Frenchman Charles Simon Clermont-Ganneau (of Moabite Stone fame) discovered the Court of the Gentiles inscription demonstrating the existence of Herod’s Temple. Almost every stone of this temple had been cast down, fulfilling Jesus’s prophecy in Mark 13:1–2.; one stone bearing the inscription “to the place of trumpeting” (described in Josephus).

In 1990, an ossuary (bone box) was discovered in Abu Tor, Jerusalem (by a bulldozer clearing land) of Jewish high priest Josephus Caiaphas (name confirmed by Jewish historian Josephus), who condemned Jesus to death (pp. 195–197).

The Pool of Siloam, previously denied to have existed by liberal scholars, was unearthed in 2004, during works to mend a broken sewer pipe. Fed by Hezekiah’s tunnel, it was the size of two Olympic swimming pools.²²

Recently, two 1st-century Jewish homes were excavated and attributed to the Apostle Peter’s and Jesus’ family homes in Nazareth. The latter claim is quite extraordinary. It was enclosed within foundations of significant Crusader and Byzantine (AD 5–7th-century) churches—likely marking a location considered highly sacred. An account from AD 680 demonstrates an early tradition that the boyhood home of Jesus was believed to be marked by the church buildings.²³

More OT discoveries

Hammurabi Code

Discovered by Gustave Jéquier, a Swiss Egyptologist, in 1901, in the Persian city of Susa (Shushan). The black basalt stele stands 8 ft tall, covered in Old Akkadian cuneiform and crowned with a bas relief of king Hammurabi of Babylon, receiving laws from a deity. It was captured by the Elamites in the 12th century BC but remained buried until modern times. The stele contained 282 laws, which corroborated details from the Patriarchal period (e.g. 20 shekels for the price of a slave—an exact figure known only during that time, the status of sons born of concubines and wives, and protection of the weakest in society).²⁴ As Metaxas rightly points out, such concurrent details implied Genesis could not have been composed a thousand years after the time it described, as skeptics claim (p. 237).

In a prophecy condemning Jehoiakim of Judah, Jeremiah 22:14 includes



Figure 4. Christopher Hitchens was a vocal critic of religion and a committed atheist

specific details of Jehoiakim's lavish lifestyle, including 'cedar windows painted with vermillion'. These were excavated in 1959—beautifully preserved from the 7th century BC (p. 239).

Sodom and Gomorrah

William Albright identified five cities at the south-eastern Dead Sea shore he believed to include Sodom (Bad edh-Dhra) and Gomorrah (Numeria). Because of his stature as the leading 20th-century biblical archaeologist, these identifications remained uncontested—until 1996, when archaeologist Steven Collins started his investigations. In 2005, Collins excavated previously unexplored Tall el-Hammam, which he believed to be Sodom. It measured nine storeys high and was vast in area (ten times Jerusalem's area), situated north of Israel's Dead Sea in the Kikkar 'disk', like the plain described in Genesis 13:10. Collins discovered evidence of settlement abandonment for seven centuries. Excavated strata was found to contain an acrid layer of ash at the expected time (1700 BC) of the conflagration event described in Genesis 19. This 'Bronze Age Gap' is repeated in all five cities of the plain. But, outside it, mounds show evidence of continual habitation (p. 251). However, despite Metaxas' enthusiasm, Collins' site is by no means universally accepted.²⁵

The Four Horsemen of the New Atheists

Metaxas severely critiques the New Atheists, especially saving his ire for Christopher Hitchens (figure 4)—whom he attacks with equal bad temper as Hitchens attacked all who he deemed 'religious'. I found this section of the book most tedious to wade through.

According to Metaxas, the 20th century's foremost atheists turned to God: Jean Paul Sartre, Albert

Camus, and Antony Flew.²⁶ They became disillusioned with atheism and its accompanying nihilism and desperately searched for meaning. They found purpose in a 'creator', even the God of the Bible (pp. 287–302).

Atheism's founding myths shown to be hollow

Metaxas shows the atheists' canard that faith and science are at odds to be completely fallacious—the Christian worldview gave birth to science. CMI has much to say on this.²⁷ The list of historical and modern scientists who are YECs is vast; notably, the founding fathers of each branch of science.²⁸

The Galileo affair

Metaxas does a good job in demonstrating that one of atheism's foundational myths is hollow, in his historical summary of what happened with Copernicus, Galileo,



Figure 5. James Ussher, Archbishop of Armagh and Primate of All Ireland between 1625 and 1655

and the church. It was never a case of science vs Christianity, but Aristotelian cosmology and Ptolemaic astronomy, the ruling scientific paradigms of the day, were revealed to be wrong (pp. 333–346).²⁹

Metaxas recognizes atheism's myths must be publicly rejected—I agree! He then reverses the argument and asks, is atheism incompatible with science? The answer is yes—because the inductive method means that unless we have universal knowledge, categorical statements like 'God does not exist' cannot be made (p. 355).

Atheism's moral bankruptcy

Metaxas quotes John Lennox to good effect, who states:

"Like me, there are many scientists and others who think the New Atheism is a belief system which ironically provides a classic example of the blind faith it so vocally despises in others" (p. 363).

For instance, why are atheists angry at the Nazis for murdering millions in the name of social Darwinism? On what basis, when evolution provides no basis for morality?³⁰

Anti-YEC

Sadly, Metaxas unabashedly mocks YECs; for instance:

"Dawkins delights, for example, in bringing up the case of Archbishop James Ussher ... who dated the beginning of the universe to the evening of October 22 in the year 4004 BC. Any serious Christian today finds this ridiculous and of course dismisses it for any number of reasons It is today unavoidably comical that Archbishop Ussher made his assertion ... most human beings in Christendom never heard of Archbishop Ussher, even during his lifetime" (pp. 323–324).

This is astonishingly arrogant and astonishingly wrong. Bishop

James Ussher (figure 5) was a brilliant scholar—universally recognized as such—along with his *Annals of history*.³¹

Conclusion

Metaxas provides some useful discussion on biblical archaeology—but, apart from the most recent finds, nothing new that can't be found elsewhere.³² Sadly, he dismisses Genesis 1–11 as historical and openly mocks the YEC position, without any theological reflection on the essential problem of death before sin that old-earth compromise brings. Throughout, he uncritically promotes big bang cosmology. Metaxas even compares it with belief in Jesus' Resurrection:

“... Christians unequivocally believe that Jesus rose from the dead ... [it's not] easily understood or believed. They know that it happened, it is a miracle. Like the Big Bang, it defies everything we know from science, but there is too much evidence for us to ignore it” (p. 306).

Ironic in the extreme, I consider his statement distasteful at best. It betrays astonishing ignorance regarding the limits of science and represents a hopelessly confused admixture of rank presumption and sophistry.

Is atheism dead? Not quite. Metaxas's verbose, tendentious style makes his tome a tiresome read, and, along with his prior commitment to cosmological and geological evolution, his book will likely lull atheists to sleep.

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The promises and pitfalls of correlating Y chromosome genetics to human history

Traced: Human DNA's big surprise

Nathaniel T. Jeanson

Master Books, Green Forest, AR, 2022

Robert Carter

Dr Nathaniel Jeanson, a fellow creation geneticist, has recently published *Traced: Human DNA's Big Surprise*,¹ a book that claims to explain biblical human history using genetics. An endorsement on the book cover says he has “found the Rosetta Stone of human history”.

The book is sparking a lot of interest within the creationist community, and for good reason; it is the first book of its kind. He has done a significant amount of research and deserves commendation for an interesting hypothesis. Full disclosure: Dr Jeanson and I have discussed these issues in depth over many years. He even had me review one of the chapters prior to publication, for which I received a glowing acknowledgment. The observations made in this review are purely in the interests of robust peer review, which we believe to be a healthy exercise when promoting various hypotheses.

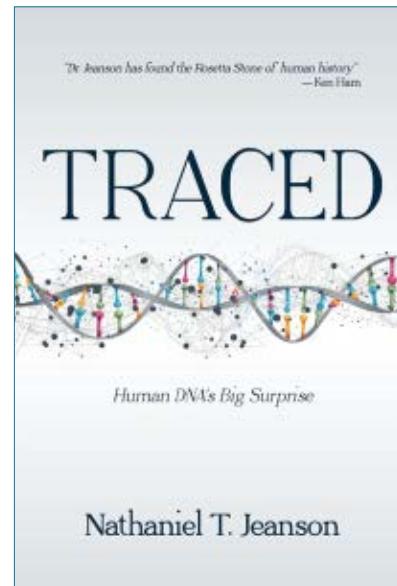
Grammatically and orthographically, the book is excellent. Structurally, the book reads well, in that it follows a logical path. There were a few sections, though, that were essentially unreadable due to numerous statistics crammed into single paragraphs. Most people would have great difficulty following such lines of thought.

A second issue has to do with the book's layout. The centre third of

the book is composed of 235 colour plates, to which the author refers frequently in the text. There are no other illustrations in the book, so the reader must constantly thumb back and forth between what is being read and the illustration that goes along with it. Many of these colour images could easily have been done in black and white and inserted into the text.

A third issue appears early on. The analysis begins without explaining to the reader what is going on. For example, how does a person compute the ‘age’ of a group of people or the timing of a historical event from a phylogenetic tree? This is not explained, but multiple hard dates start appearing near the beginning of the book. They are cited with no qualification and no explanation of where they came from. It would have been beneficial to have provided a brief explanation, with a pointer to detailed methods in the included appendix. There are hints in the text (i.e. in a few footnotes) that this material was once part of the main text. If so, its removal may have simplified the material, but the lack of explanation may prevent supporters from answering skeptical objections. Interested readers can follow the citation list to obtain this material, but the casual reader will miss out.

By way of explanation, he applies the general rule that three Y chromosome mutations occur each generation, except for the first generation after Noah, to which he applies seven mutations. The figure of ‘3’ comes from his analysis of Y chromosome sequencing studies.² It is not trivial to derive mutation rates from sequencing data, because the error rates inherent in the data are on the same order of



Nathaniel T. Jeanson

magnitude of the *in vivo* mutation rate. Thus, all papers published on the subject to date have applied significant filtering steps to the data before the final estimates are reported. This is frustrating, to say the least, since an accurate estimation of the mutation rate is one of the things that will separate the young-earth and the evolutionary models of human history.

Finding Noah

Jeanson includes one large Y-chromosome tree (figure 1), but does not explain why the tree starts at his chosen point and not where the evolutionists want it to be. There is an appendix that explains some of these major assumptions, but the explanations were overly technical and thus not very helpful. Presenting a creationist model for human history is important, and Jeanson needs to be complimented for being first to do this. Yet, a comparison to the evolutionary model would seem to be very desirable in a book of this nature.

Dr Jeanson also picked a specific ‘root’ for the human Y-chromosome tree. He has documented this in several publications but does not discuss the other viable alternatives in *Traced*. Once that root (e.g. Noah) is chosen, it is possible to count the number of

mutations from the root to the tips of the branches on the Y-chromosome tree. Since the length of each branch is proportional to the number of mutations each individual carries (some averaging occurs in the inner branches), by dividing this length by ~4,500 years (the time since the Flood), one can obtain a mutation rate for each major branch. He uses an average rate for each branch, though, because not all individuals are equidistant from their group ancestor.

There are other ways to represent the same data. Figure 1 was derived from a diverse set of Y chromosomes reported by Bergström *et al.* (2020).³ Figure 2 is an unrooted tree that represents the Y chromosomes reported by the Simons Genome Diversity Project,⁴ which was reported in Carter, Lee, and Sanford (2018).⁵ Even though the data are displayed differently, the major branches are represented in both trees. This has implications for the question of potential ‘missing’ branches in modern data sets, as will be discussed below.

This approach has the advantage of not requiring a monotonic molecular clock across all lineages, all geography, and all time. However, and he admits this in the book, this necessitates that some lineages have a higher mutation rate today or at least had a higher mutation rate in the past. Since the most discordant lineages are in Africa, he appears to be saying that (some) Africans are more mutant than non-Africans.

A respected colleague who works in this field has strongly cautioned against saying anything like this in public. Yet, if something is true it needs to be said, so there remains an open question: are mutation rates variable among populations? Evolutionists partially avoid this problem by placing Y Chromosome Adam on an exclusively African branch. This reduces the extreme differences seen in Jeanson’s tree, but it does not completely avoid the problem, because some groups are still farther from the root than others, as has been documented elsewhere.⁴ Also, since non-Africans carry much more

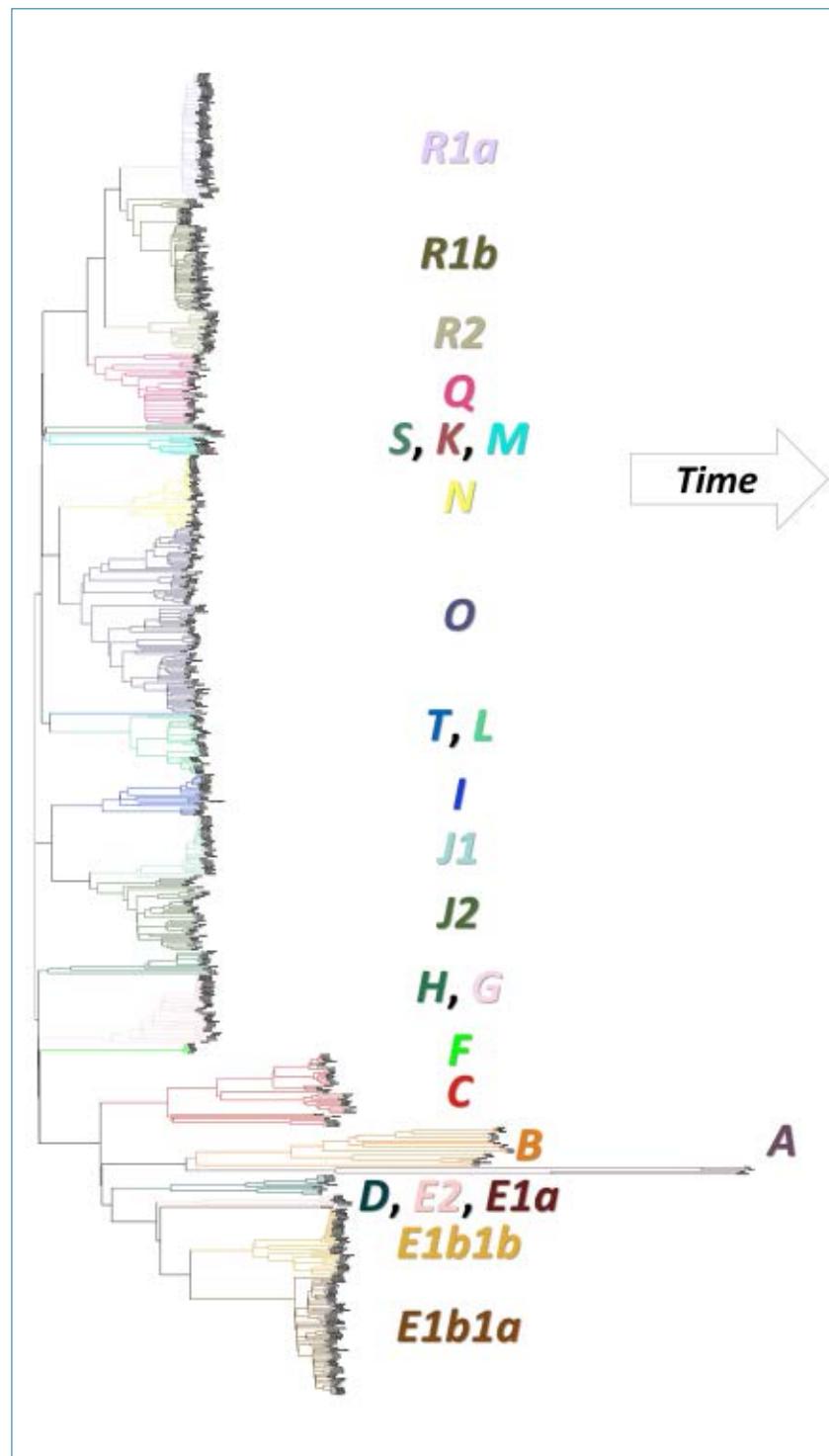


Figure 1. Jeanson’s phylogenetic tree of human Y chromosomes. He chose to place the root (Noah) at one of the major break points in the tree, but since the mutation count increases from left to right, note how this necessitates that some people are more ‘mutant’ than others. Had he chosen another branch point, say the place where groups F through to E1b1a split, the mutation counts would have been more similar between groups. Historically, group A is exclusively African and group E1b1a is majority African. The other groups are found in various places across the world. For example, group O is quite common in East Asia, group R1b is the most common Y chromosome in Europe, and group Q is associated with Asians and Native Americans.

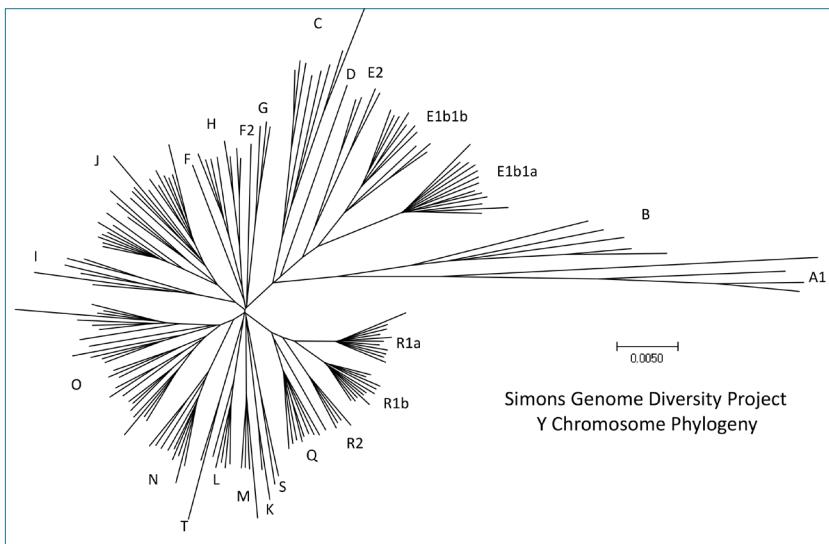


Figure 2. An unrooted neighbour-joining phylogenetic tree of human Y chromosomes, based on the Simons Genome Diversity Project (SGDP) data (from Carter, Lee, and Sanford, ref. 5). Note that the evolutionary root lies along the branch labelled A1, about halfway between the terminal branches of A1 and the most distant branch tips on the left side of the chart. This is not far from any of the alternative biblical roots (which all lie near the centre of the 'starburst'), but there should have been some discussion of the different placement options in the text.

Neanderthal DNA than do Africans, and since Neanderthal DNA is highly divergent from that of modern humans, one can conclude that non-Africans carry many more mutations in their nuclear genome than do Africans. This partly blunts the non-politically correct aspects of the divergent African lineages.

Yet, the most important parts of the tree are the earliest, inner branches. There is a lot we do not know about this early period in human history. One cannot estimate the number of generations that separates any two closely spaced branches based on the number of mutations. A single-base difference could arise between men separated by zero (brothers), one (cousins), two (second cousins), or more generations. Assuming mutations are random, even if things average out over long periods of time, we cannot put our finger on a phylogenetic tree and know how many generations separate people who lived close in time.

Interestingly, his method iteratively calculates the mutation rate for each branch and sub-branch separately. This

creates the scenario where it is possible for the mutation rate to change depending on which branch one is following, but it synchronizes the mutation rate where any two branches join. Thus, it is possible to calculate different times for the same event depending on which groups are included. Jeanson is aware of this quirk, but it does not seem to affect any of his conclusions.

The molecular clock concept (even if only applied to the local tree topography) is a simplifying assumption in Jeanson's model. This does not make it wrong, *per se*, but it does qualify his conclusions. For example, there are several ways for mutation rates to have been enhanced in the past. Higher radiation loads due to people living on newly exposed rocks that contain uranium, a fluctuating magnetic field of the earth (which would produce pulses of increased cosmic ray activity at the surface), and changing radionuclide decay rates could all affect mutation accumulation rates. Recent work has shown that specific modern individuals can pass on up to 7-fold more mutations to their children than average. These

people are rare (12 out of 21,879 individuals studied), but they are present. The excess mutation rates were associated with defective DNA repair systems (two families) or the exposure to chemotherapy agents prior to becoming a parent (five families). Also, nine of the 12 hypermutating individuals were male, and paternal age was a significant contributing factor.⁶ Even though the burst of excess mutations was not associated with disease in any of the children, this does tell us that extrinsic factors can affect inter-generational mutation accumulation rates.

However, patriarchal drive is a strong mutational force (figure 3)⁷ which is virtually ignored in *Traced*. The Bible says people lived a long time in the past and many had children at great ages (cf. Genesis 5 and 11). We know from science that older fathers pass on more mutations. Estimates vary, but it is probably greater than one extra mutation per additional year of paternity.⁸ The reason for this is that male reproductive cells continue to divide from puberty to death, and every time a cell divides, more mutations are added to the genome. The female reproductive cells undergo fewer cell divisions before they are ready and then remain in an undividing state until ovulation and fertilization many years later.⁹

Thus, males are the main contributor of most single-letter changes and the post-Flood Patriarchs would have been producing children with a lot more mutations than the modern average as they aged. These children would naturally have had a high status in the rapidly growing population, but they would also have become rare as the population ballooned. In essence, after a few centuries, there would only be a handful of long-lived people living in a sea of short-lived people who are many generations removed from Noah. What this means is that you can't necessarily look at the length of a branch on the family tree and divide by '4,500 years' to get a mutation rate. The branching pattern does not change when you

invoke higher mutation rates in the past, but the timing of events does.

It is also not true that Shem, Ham, and Japheth should be expected to have had the same number of mutations on their Y chromosomes as Noah. In the testes, spermatogonia reproduce clonally, and the cell count for any particular clone waxes and wanes over time.¹⁰ Since Noah was over 500 years old when his sons were born (Genesis 5:32), we can reason that they would have been born with many mutations (possibly a major factor in the sharp drop of lifespan from Noah to Shem¹¹). However, the exact number would depend on which spermatogonial lineage contributed to each of the sons. It is entirely possible for two of them to have been born with essentially identical Y chromosomes while the third could have had a radically different Y. Or they could all have had identical Y sequences. Or each could have had a unique sequence. We cannot know, so it is impossible to place Noah and his sons on any chosen internal node of the Y-chromosome family tree. All we can say is that we expect them to be near the centre of the starburst.

Ancient DNA is a creationists' friend

Traced includes no significant discussion of the burgeoning new field of ancient DNA (aDNA) studies. There is a trend among many creationists to discount aDNA.¹² Many claim the data are riddled with errors and, therefore, cannot be trusted. Jeanson is not necessarily of this mindset. He indicated (personal communication) that the model worked so well without it that he saw little reason to include a discussion of aDNA, yet he is also open to the possibility that aDNA could be included in future creationist work on human history.

In reality, aDNA has finally opened up the murky world of early post-Flood history to us. We should be studying it intently while trying to turn the evolutionary conclusions on their ear. Are there errors in the data?

Yes, many. This means we cannot be certain about the mutation load of any specific individual, because many of the 'mutations' they carry could easily be due to post-inhumation chemical degradation of DNA. DNA sequencing is already an imperfect science. Adding non-canonical nucleotides to DNA is problematic. For example, the deamination of cytosine occurs easily and frequently both in the cell and in the ground. This creates uracil, which does not belong in DNA and must be accounted for before any DNA amplification steps are performed on aDNA. This does not mean, however, that much information cannot be drawn from aDNA.

Isolating aDNA is like finding an old book that has been buried for a long time. It might be riddled with worm holes, have pages missing, and be covered in mould spots. Yet, at any stage before complete destruction, it should be possible to discriminate between old copies of, say, the Bible, a collection of Shakespeare's sonnets, and Tolstoy's *War and Peace*. In fact, some of the greatest discoveries for Christianity involved pulling dilapidated old tomes from mouldy monastery shelves, which allowed us to track various manuscript families, in some cases, due to introduced copying errors (similar to the way we track genetic mutations). If we had ignored that material because it was 'error prone', we would have missed much.

With aDNA, we can see the progression of people in places like Europe: from Neanderthals to hunter gatherer societies to ancient farmers to modern Europeans. We can see where the 'light skin' genes entered Europe and where they came from (e.g. Anatolia).¹³ We can also see that the people most like modern Europeans in their genetics lived in the Central Asian steppes and did not enter Europe proper until rather late in history.¹⁴ Similar stories of ancient migrations and gene flow can be told for all major regions of the world. aDNA should not be rejected by the creationist community. Instead, we need to incorporate it into our ideas of history, to whatever extent possible.

We will, of course, reject the secular timeline, but the relative order of events is easily seen.

For example, when looking at ancient Europeans, it is clear that they have different genetics compared to modern Europeans. In fact, post-Neanderthal Europeans almost universally carry alleles that are associated with dark skin and blue eyes.¹⁵ So many people have been discovered with those alleles that no level of statistical guesswork is required. Likewise, every time we sequence a new Neanderthal, it clearly falls among other Neanderthals, including the alleles that separate Neanderthals from other humans.¹⁶ In Denisova Cave, near the border of Russia, China, and Mongolia, a girl was found who was ½ Neanderthal and ½ Denisovan, but the Neanderthal half was not related to the Neanderthals who were buried only a few feet away. Instead, the Neanderthal part was related to Neanderthals found in Croatia, thousands of miles away.¹⁷

Also, given a 3-billion-letter genome, and given the fact that only a relatively few nucleotides are phylogenetically informative, the usefulness of aDNA is a matter of statistics. One can infer which branch an individual belongs to even with highly fragmentary DNA. Creationists who reject all aDNA studies are missing a wealth of information that tells us about population growth and movement in the darkest periods of human history. This is the true 'Rosetta Stone'.

Is aDNA accurate? Yes, depending on what you are trying to glean from it.

Important information missing

Strangely, in a book about human history, there is no discussion of the genetics of ancient people like Neanderthals and Denisovans. Jeanson would agree that these people were human, and thus descendants of Noah, but where do they fit in? Worse, some living people are up to 7% Denisovan and 3% Neanderthal.¹⁸ Should we not talk about how they can be 10% 'non-modern' in a Flood/Babel context?

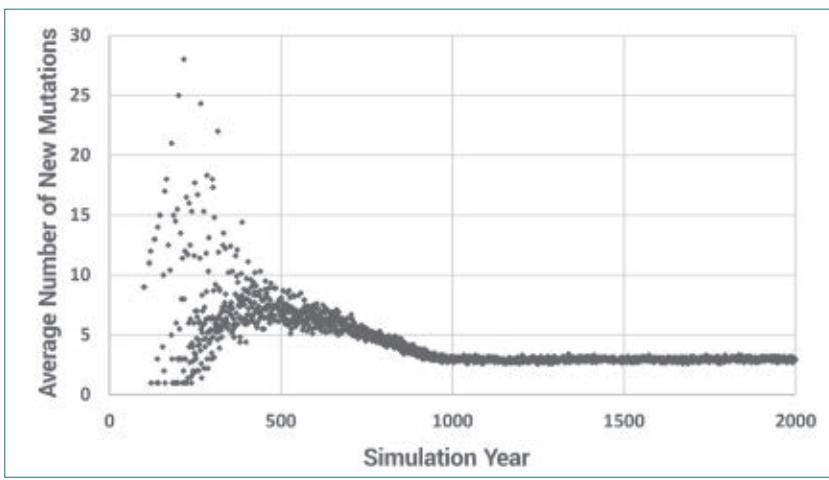


Figure 3. The average number of new Y-chromosome mutations per year in a model post-Flood population with waning ages and an initial long lifespan (from Carter, ref. 7). Note that these are averages. Many children are born each year, but some have many more mutations than others because some are born to ancient fathers and some to young fathers. The effect of patriarchal drive means that the early branches in the family tree cannot be treated in a clock-like manner.

There is also little discussion of the archaeological evidence for the most ancient human occupation, how it reflects the initial post-Babel wanderings and how the ancient-most people may or may not be related to the modern people living in those areas today.¹⁹ Also missing is any discussion of mitochondrial genetics and how mtDNA can also be ‘traced’ back in time. He admits to not knowing much about history several times in the book, so the reader is left wondering if his conclusions are more tentative than they seem.

Major differences of opinion

While there are many interesting facts presented in *Traced*, areas of disagreement will necessarily appear. For example, when discussing which Y lineage represents Abraham, *Traced* discusses the Cohanim, a group of Jewish men who claim direct descent from Aaron. Yet the book discounts the one lineage with the highest representation among the modern Cohanim (J) and opts for another (T). When discussing the Lemba of southern Africa, he notes that this alternative Y chromosome is found among them, but he never mentions

that the Cohen Modal Haplotype (a subset of J) is also found among them, and that it is found among the men who serve as priests.²⁰

Granted, statistical probabilities are not historical realities. The original founding group for a modern population could be a minority group (or absent altogether). Yet, there are good reasons for *not* assuming that the majority Y chromosome among the Lemba represents the founding lineage of the Jews. Their own account says they were founded by a small number of Jewish mariners. This is not a robust sampling of a population, and commercial endeavours like this are often undertaken by closely related males. For example, Peter and Andrew were brothers (John 1:40), and the brothers James and John were their partners in the fishing business (Luke 5:10). If a group like this had become marooned on a foreign shore, there would be no reason to assume their descendants would represent the majority Y chromosome among the source (Jewish) population. Alternatively, they may have hired random, non-Jewish sailors for the voyage, meaning there might not have been any correlation between Lemba and Jewish Y chromosomes. It

is possible that T is the haplogroup of Abraham, but J is more likely.

This has follow-on effects. Discounting group J as the Jewish ancestral group flips the major branches that can be attributed to Shem and Japheth. This restricts Japheth’s descendants to the Middle East and sends Shem’s descendants across Eurasia. There is nothing wrong with Shem being widely distributed, but the tenor of the Table of Nations regarding Japheth indicates that his people were spread far and wide (c.f. Genesis 10:5), specifically along the Mediterranean coastlands, which opens up exploration of Europe proper.

He indicated (personal communication) that the answer to the riddle of J vs T for Cohanim ancestry was derived from other data, inside and outside of the Bible, and corresponds with many independent metrics. This was not clearly explained in the book, and the conclusions seem to have been arrived at prematurely. This is an area for continued discussion and analysis.

Traced also spends much time talking about the founding lineages for people groups mentioned in Genesis 10. Many will disagree with his quest to assign Y chromosomes to specific people groups. For example, is it possible to identify the ‘Persian’ Y chromosome? Differences among Y chromosomes have no phenotypic effect, so one cannot tell which man is related to whom by outward appearances. People groups also mixed in history, and armies frequently used foreign mercenaries, so any army is likely to include a diversity of Y-chromosome lineages. Also, just because an army invaded some area does not mean that they exterminated every single male in that region. What ‘Persian’ Y chromosome would one expect to find? The lineage of the king might be known, but his Y chromosome might be quite rare compared to the diverse people over which he rules.

Molecular clocks create highly unlikely scenarios

Based on Jeanson's molecular clock approach, he is forced to conclude there was a 100% replacement of all Native American Y chromosomes (group Q in figures 1 and 2), from northern Canada to Patagonia, just a few centuries ago.²¹ He cites one Native American oral history in the book to back up the claim and tries to give a mathematical exposition on how such a thing could occur.

Consider what it would take to replace all Native American Y lineages with a single lineage that arose recently. The population would have to contract to near extinction (amounting to something like a 99.999% reduction) and rebuild from a specific small subpopulation, leaving most of both continents uninhabited for centuries. There is no evidence for that. Alternatively, a single tribe would have had to to invade from Asia and exterminate every single male Native American across both continents. To put it simply, this is highly unlikely.

A general reduction of the population across the entire inhabited area also does not work, because the resulting family tree collapse would occur at random. The arrival of the smallpox virus after 1492 was not even able to produce a scenario where all Native American male lineages trace back to a single individual, and various estimates suggest the population decreased by over 90% due to disease in the post-Columbian era. The frequencies of the various lineages before and after the reduction should be preserved during periods of population collapse. Even at extreme levels of reduction, any given small subpopulation would contain a random sampling of the original Y-chromosome diversity. The probability that they would all end up with the same branch, at random, is vanishingly small. To say that, at random, all lineages but one peter out across both continents is making a statistically indefensible argument. If this is what the data are telling us, then so be it. But, the effects

of patriarchal drive would create a situation where branches grow more quickly in the early post-Flood years than in later years. Thus, the date for the Y chromosome ancestor of Native Americans given in *Traced* could easily be inflated. Positing an earlier date for the formation of the Native American branch removes the requirement that all paternal lineages were replaced long after these people crossed over from Asia.

Are there more Y-chromosome lines to be discovered? Probably not, for the tree has been fleshed out. That is, statistically, the likelihood of finding additional major branches is going down rapidly. The last major discovery was of a unique Y chromosome that was discovered by Ancestry.com. An American man named Albert Perry, a descendant of African slaves, carried a Y chromosome that has now been assigned to group A00. Further work turned up similar Ys in Cameroon.²² We now have *millions* of Y-chromosome sequences in private and public databases and no other major branches have been revealed. Does this mean that no new discoveries will be made? Not necessarily, but we should not be expecting that the Y-chromosome family tree will look much different in the future.

Conclusions

Traced represents a significant milestone in creationist literature, in that it represents a major attempt to bridge the gap between biblical history and modern genetics in book form. The conclusions are perhaps more tentative than the claims of the book indicate, so readers should be cautious about taking what is said as the final word. Much more work needs to be done to bring ancient DNA into the fold, and better mathematical models of human population and genetic history still need to be developed.

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Strengthening the Shishak/Shoshenq synchrony

Gavin Cox

Seven supporting evidences are presented here, strengthening the traditional synchrony that Shoshenq I, an Egyptian Pharaoh of Libyan descent, is biblical Shishak, who looted Solomon's Temple. There was an official variant spelling of Shoshenq, without 'n', behind the biblical name Shishak. The Hebrew translation of Shishak's name reveals his 'lustful desire for tribute'. A new hieroglyphic translation of an inscription on Shoshenq's triumphal relief at Karnak indicates tribute came from Judah. By 'following the money', a mysterious passing of great wealth to Shoshenq's son, Osorkon I, is explained by the transfer of Solomon's looted treasures. Evidence reveals Solomon's wise administration influenced that of Shoshenq. Direct archaeological evidence demonstrates Shoshenq I campaigned in Israel.

Chronology is one of the most contested and controversial areas of Christian study, and none more so than trying to synchronize biblical and Egyptian history. The Hebrew sojourn in Egypt, and subsequent Exodus, are foundational pillars for the formation of Israel and the Christian faith. As with Genesis creation, if secular dates and interpretations are adopted, they unravel the Bible's relatively straightforward chronology. Not unexpectedly, in Egyptian records there are scant mentions of the Hebrews while in Egypt, but there are ample mentions of interactions with the post-Exodus Hebrews. The only known and rare mentions of Israel occur on the Merneptah-stele (JE 31408, Cairo Museum)¹ and possibly on ÄM 21687 (dated 14th or earlier 13th century BC).²

Yet even these associations are sometimes disputed. An example is the attempt to challenge the equation of biblical Pharaoh Shishak (who engaged King Solomon's son Rehoboam—1 Kings 11:40; 14:25; 2 Chronicles 12:2–9) with Shoshenq I, a pharaoh well attested in Egyptian records.

Evidence 1. Is Shishak Shoshenq?

Shoshenq I was the first king of the 22nd dynasty of the 3rd Intermediate Period. The 3rd IP was the second time a non-Egyptian regime ruled Egypt and it began shortly after the death of Pharaoh Ramses XI (20th dynasty/New Kingdom). The kings of the 3rd IP had Libyan origins who were originally generals under former Egyptian rule. Shoshenq conducted campaigns in the ancient Near East, recording his victories on the Bubastite Portal (named after a Libyan city) at the Temple of Karnak at Luxor. He recorded around 180 cities that he conquered in the Jordan region. Forty-three of these are names of cities and kings that are recognizable in Judah and Israel during the Divided Kingdom.

Egyptian spellings

Shoshenq is a modern name invented by Egyptologists, so we would not expect to see it written in the Bible.³ The Egyptian name typically appears in hieroglyphs as 'š-š-n-q'. Egyptians did not use vowels in their hieroglyphic inscriptions, so the reader needs to supply vowels so words can be pronounced. This is why scholars have several different variations, such as Shoshenq, Sheshonq, Sheshonk, or Shoshenk (and these are just English versions). For consistency, this article will use Shoshenq. There were eight pharaohs that shared that name, but only Shoshenq I conducted military campaigns into Israel (see later) making him the ideal candidate for Shishak.⁴

The hieroglyphic inscription for Shoshenq I (figure 1)⁵ includes his throne name in the left oval (cartouche): *Hedj-kheper-re Setepenre*, meaning: "Bright is the manifestation of Re, chosen of Re." The right cartouche spells out his birth name: "Shoshenq", and epithet mery-Amun.⁴

No 'n' in Shishak?—No problem!

The names Shoshenq and Shishak (2 Chronicles 12:2–5) are similar, but there is an obvious difference in that the strong nasal 'n' is absent from the biblical name. However, there are Egyptian scribal examples where the 'n' (~~~~) in Shoshenq was dropped, i.e. ššnq = ššq (~~~~) (see figure 15).

The following are the known variations in spelling of the name: ššnq, ššnqj, ššnq(j), ՚nḥ-ššnqj, ՚nḥ-ššq, ššq-՚nḥ, and ššq.⁶ What proves the point beyond doubt is when both variants appear together in one text, such as the Stela of Shoshenq I, Gebel es-Silsilah, Aswan. Here the scribe spelled Shoshenq I as both ššnq and ššq (figure 2).⁷

These monumental inscriptions (dated to year 21 of Shoshenq's reign) demonstrate ššq was an officially accepted variation.⁸ That there are two official spellings may reflect the difficulty of accurately transcribing the Libyco-Berber velar



Image: O.S.M. Amin/Wikimedia, CC BY-SA 4.0

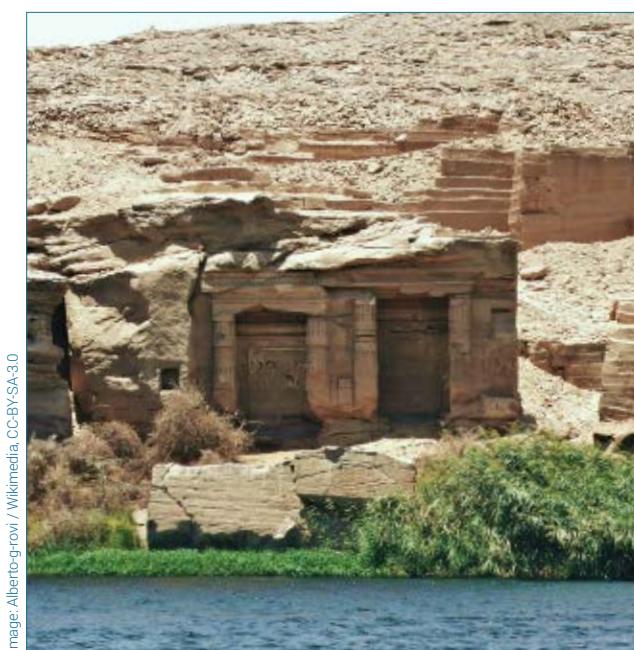
Figure 1. Birth and throne names of Shoshenq I, from his Canopic chest

Image: Alberto-grov / Wikimedia, CC-BY-SA 3.0

Figure 2. Stela of Shoshenq I, Gebel es-Silsila, Aswan, where his personal name is spelled *ššnq* and *ššq*

nasal phoneme /ħ/ [nq], which exists in neither Egyptian nor Semitic.⁹ Finally, from a phonetic standpoint, there are clear correspondences between Egyptian <š>, Hebrew *š*,¹⁰ Egyptian <q> and Hebrew *ר*.¹¹

Hence, Egyptian *ššq* (minus the vowels) sounds exactly like Hebrew Shishak. The revisionists' claim that Shishak could not be Shoshenq, because it lacked the nasal 'n', is therefore unfounded.¹² Levin adds further linguistic reasons why Egyptian Shoshenq became biblical Shishak. He states:

"In Hebrew, the sounds 'n' and 'm' are what linguists call 'weak', and are sometimes dropped, this is especially true in proper names. For example, we know that the city of Gath was spelled Ginti or Gimti in Egyptian inscriptions. And Hebrew Makkedah was

spelled Manqedah in Aramaic. So it is no surprise that the Egyptian name Sheshonq became Shishak in the Hebrew Bible. The 'n' has simply been dropped. As far as the shift from 'q' to 'k', that's just a matter of transliteration. Shishaq would more correctly be spelled Shishaq, but Shishak is the spelling found in most English Bibles."¹³

Was Shishak a Ramesses (II/III)?

New Chronologists (notably David Rohl) argue that the Egyptian hypocoristicon (shortened non-official form) of Ramesses II (*Sysw*) can be understood to be the basis of the biblical Shishak. However, the hypocorism of Ramesses II is rare in the monuments and would therefore likely not be known to the biblical writer, or his readers.¹⁴

Evidence 2. Shishak's Hebrew meaning

The shortened version of Shoshenq's name, *ššq*, would be meaningless to readers of the Hebrew Bible. The biblical writer therefore devised an association with a Hebrew meaning to aid comprehension and memory of the name for the readers.

When the words used to make up Shishak in Hebrew are recognized, a perfect description of his actions and attitude is elegantly revealed. In the Hebrew Bible, Shishak appears as *שִׁשְׁק* (*šišqaq*). This could well be a combination name made up of two words: *ש* (*say*), a noun: 'gift, tribute, offered as homage' (*HALOT-9542*) plus *שַׁק* (*šuq*), a verb: 'to fill with longing, desire, craving' (*HALOT-9470*).¹⁵

Here are examples of both words used in biblical context (orange text):

בְּעֵת הַהִיא יַוְבֵּל־שִׁישְׁק לִיהְוָה צָבָאות
"At that time **tribute** will be brought to the LORD of hosts . . ." (Isa 18:7).

אָנָּי לְדוֹדִי וְעַלְיִ תְּשַׁׁקְּחָנָה
"I am my beloved's, and his **desire** is for me" (Sol 7:10).

Combining both words, we have: *שִׁשְׁק*.

However, this is not the same as *שִׁשְׁק*, because it has no *vav* (ו). If the name is a combination of 'tribute' + 'to desire', then there is a missing middle *vav* (ו) in the verb *שַׁק* (*shak*), 'to desire'.¹⁶

The answer may be that Hebrew verbs possessing middle *vavs* (termed 'weak verbs') are written without a *vav* on specific occasions—to turn simple verbs (*qatal*), into perfect third person masculine singular verbs (*qatal*). Specifically, *שַׁק*, meaning 'to desire', becomes *שָׁק*, 'he desired'. Therefore, the name *שִׁשְׁק* means 'he desired tribute' (contra Habermehl).¹⁷ Furthermore, the verb's subject (Shishak) is itself derived from the combination of noun + verb—a very

neat literary device! The combination elegantly describes Shishak! He lustfully desired Solomon's gold as a bribe and tribute to spare Jerusalem.

Supporting evidence comes from a phonetically near identical name found in 1 Chronicles 8:14, 25 שָׁשָׁק (*šāšāq*). Jones translates this as 'vehement desire', which he explains comes "from the root שָׁשַׁק shuq, to run after, to desire, to overflow . . .".¹⁸

Pardon the pun

There are hundreds of examples of punning in the Hebrew Bible.¹⁹ This literary technique, called 'paronomasia' (punning), has 12 varieties. Two relevant types include: 'polysemy', which combines two etymologies into a single word, and 'hendiadic paronomasia', which combines two different words to convey a single idea or action.²⁰ Hence, pairing two words to make one meaning is a recognized biblical literary technique. Furthermore, biblical writers changed spellings of names, and places, to make them significant in Hebrew—either to mock or describe people's actions.

For instance, the name 'Jezebel', the Zidonian wife of Ahab, the infamous king of Judah (1 Kings 16:31), means something like 'Baal exults'. Scholars have pointed out her name was deliberately spelled to sound something like 'where is the piece of dung?'.²¹ An association mockingly utilized by Elijah in his prophecy against Jezebel (2 Kings 9:37).

The Babylonian king Nebuchadnezzar is spelled five different ways in the Hebrew Bible. (Derived from Akkadian *Nabū-kudurru-uṣur*, "Nabu has protected the son who will inherit", HALOT-5928). The Bible puns on his name and, of interest to this study, his loot-taking from Jerusalem. Here the name's ending is made to sound like 'treasure' in Hebrew (cf. II Kings 24:13).²²

If Shishak is understood to mean 'he desired tribute' in Hebrew (contra van der Veen),²³ it perfectly encapsulates his actions and attitude in desiring Jerusalem's tribute.

Evidence 3. Judah's tribute

One Bubastite Portal name ring has caused contention. Naturally, it sounds like it connects to Jerusalem, the capital of Judah. However, some scholars suggest it spells out a mysterious name, 'the location of [which] is unknown'.²⁴ The particular inscription in question spells out *y-w-d-h-m-r(w)-k*, listed as no. 29 on Shoshenq's wall²⁵ (figures 3, 4).

The great pioneering French Egyptologist Champollion (1790–1832), who co-translated the Rosetta Stone, was the first to decipher Shoshenq's reliefs at Karnak. He transliterated the hieroglyph *y-w-d-h-m-r(w)-k* as *Ioudahamalek* or *yehudmalek*, meaning 'the kingdom of the Jews' or of 'Judah'. Thus, Champollion concluded that Shoshenq of

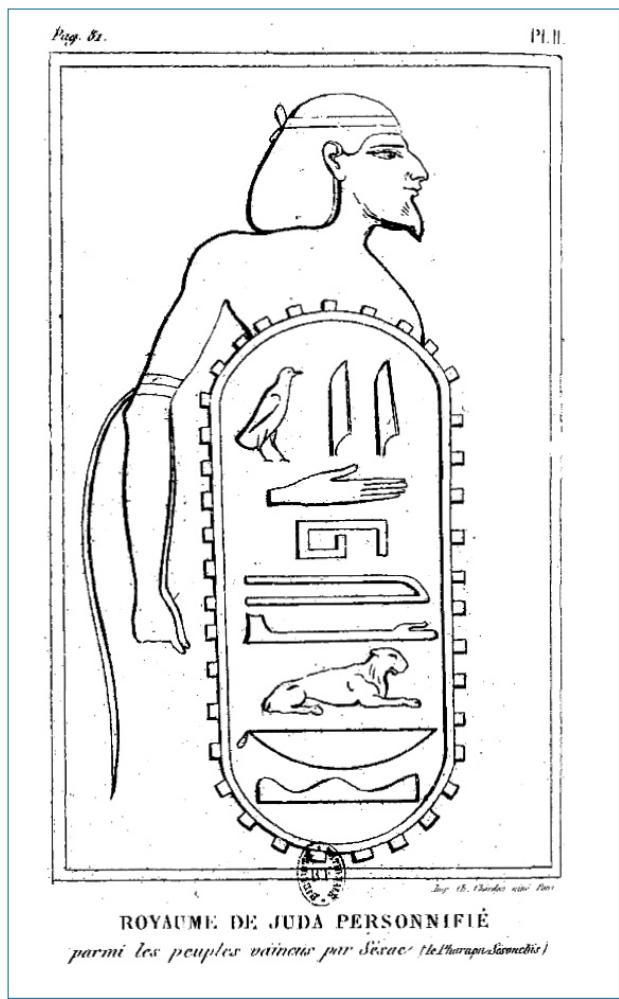


Figure 3. Bubastite Portal name ring 29, drawn by Jean-François Champollion (1829)

Image: Oncenawhile / Wikimedia, CC BY-SA 3.0

Egypt was Shishak of the Bible, who had plundered cities in the Divided Kingdom.

It is claimed that none of the conquered cities mentioned in the Bubastite Portal specifically mention Jerusalem.²⁶ Therefore, Shoshenq cannot be the biblical Shishak who looted Jerusalem's treasures.

In three sections, Shoshenq lists around 187 cities that he conquered in the Jordan region.²⁷ Of these, 27 are cities recognizable from Israel²⁸ (cf. 2 Chronicles 11:5–13). They cover south-west of Judah, north-west Israel, east and north-central Israel, and some are lost or unclear.²⁹ Figure 5 shows a plot of these on a map of Israel (Jerusalem in brackets).³⁰

It should be noted that all Judean cities paid tribute to Shoshenq I (and after that also on an annual basis). The question could be asked, why then would only one city, i.e. Jerusalem, be singled out for this purpose, if all of them had to pay? The answer to that question is simply that all Judean cities would have paid taxes to Jerusalem, and therefore

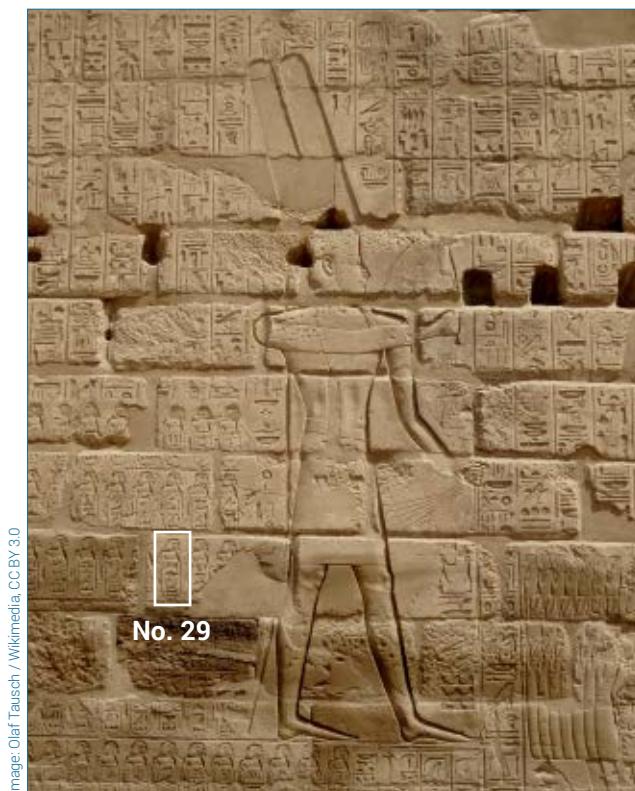


Image: Olaf Tausch / Wikimedia, CC BY 3.0

Figure 4. Section of triumphal relief of Shoshenq I with name ring no. 29 in white box

Jerusalem would have financially represented every city in Judah.

Explaining name ring no. 29

The ethnicity of the bound captive (figure 3) is Semitic in appearance (which is the case with all the name rings), with a pointed beard and bobbed hairstyle. The oval containing letters represents a city wall, replete with castellation (defensive or decorative parapets with regularly spaced notches).

The letters, readily identified from Gardiner's sign list,³¹ are: M17 'double reed' 'y' (𓂋); G43 'quail chick' 'w' (𓂋); D46 'hand' 'd' (𢓃); O4 'reed shelter in field' 'h' (𢓃); Aa15 'side/ half' 'm' (𢓃); D35 'fore arm' 'a' (𢓃); E23 'recumbent lion' 'r(w)' (𢓃); V31 'wickerwork basket with handle' 'k' (𢓃); N25 'hill-country, foreign land' (𢓃) (silent determinative). Altogether, the letters form the sound 'y-w-d-h-m-a-r(w)-k'.

By the 'hand' of Judah

What is striking is that 'y-w-d-h' is the exact phonetic spelling of Judah. However, scholars have not accepted this.³² They have preferred *yd*, a Semitic word meaning 'hand' with the D46 'hand' 'd' (𢓃) representing a silent 'determinative' (a symbol determining the word's meaning). If it means 'hand', the spelling is unique. The problem, phonetically, for this solution is that the quail chick 'w' causes the word

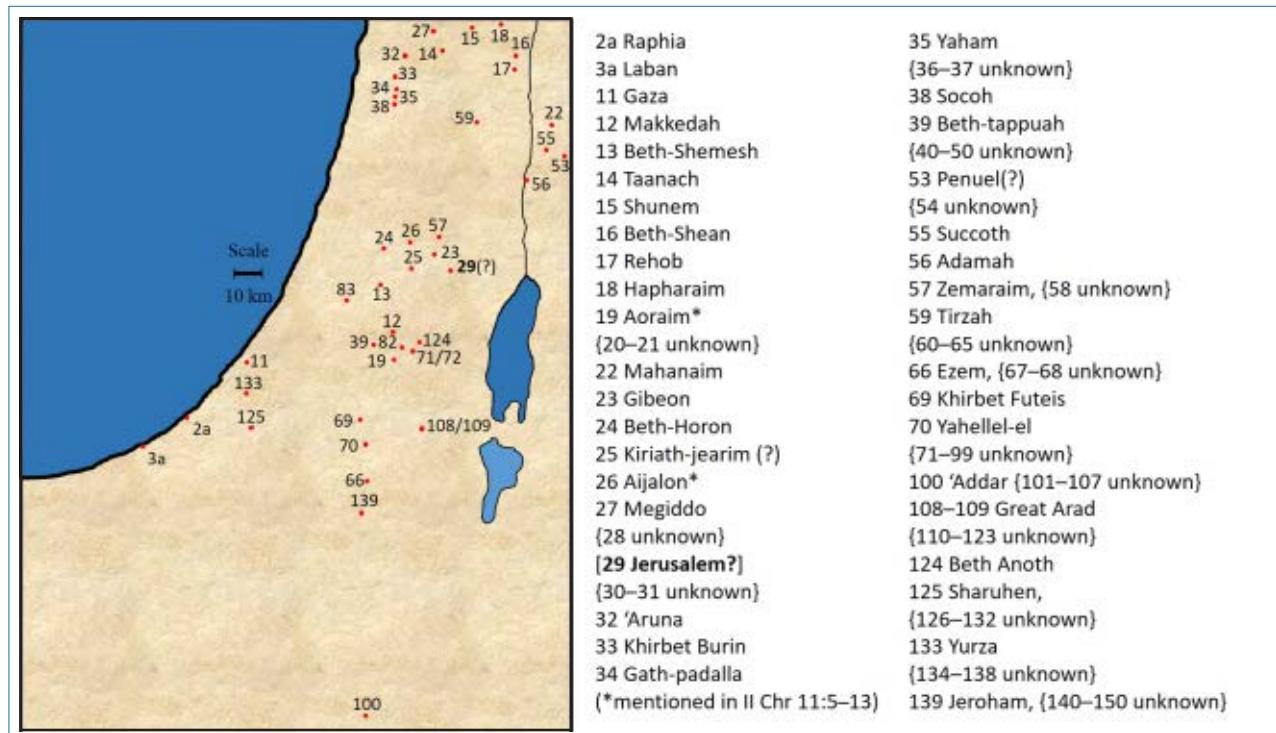


Figure 5. Location map derived from Shoshenq's triumph inscriptions (all locations are approximate; after Currid²⁸)

to be pronounced ‘ywd’, not ‘yd’. Egyptologist James Hoch says, “The Egyptian transcription with a u-vowel [u] seems phonologically suspect, but it is probably justifiable.” But Hoch does not explain why and later admits the “u-type vowel would seem to be implausible”.³³ Hoch then attributes poor grammar due to the “scribe’s Phoenician accent.”³⁴ But Hoch cannot know this. Furthermore, why would the Egyptian scribe transliterate a Semitic name, then put an Egyptian determinative after it, if it was to be read as ‘hand’ by Egyptian readers? Why not use a common Egyptian word for hand? A straightforward phonetic reading of the first five hieroglyphs clearly spells ‘Judah’ and requires no special pleading to prove it.

Judah be ‘praised’!

Brown-Driver-Briggs recognizes Judah (BDB-3841 יְהֹוָדָה) is derived from the Hophel (passive form) of יָדָה (yadah), which means ‘Praised, object of praise’. The ‘parent root’ is *yad* (יָד), which means ‘hand’ (HALOT-3547). This is demonstrated where a phonetic correspondence is made between ‘Judah’, ‘praise’, and ‘hand’ at Genesis 49:8. Judah means ‘praised’, which, in context, means ‘throwing’, ‘lifting’, or ‘pointing’ the hand towards Heaven in worship (cf. Genesis 29:35). Therefore, ‘hand’ appearing in the Shoshenq inscription is significant and could represent a clever scribal device pointing specifically to Judah’s capital—Jerusalem (assuming the Scribe had some knowledge of Jerusalem’s Hebrew meaning). Thus, the D46 hand symbol is an integral part of the word, rather than a silent determinative.

The king’s ‘tribute’—not the ‘king’

Many scholars read ‘*m-a-r(w)-k*’ as ‘*mlk*’, which is a Semitic word, meaning ‘king’ (מלך, HALOT-5239).³⁵ Granted, in many of the Bubastite Portal name rings³⁶, the Semitic letter ‘l’ is transliterated by the Egyptian scribe using the recumbent lion (*rw*) and mouth (*r*), as Egyptians did not pronounce ‘l’ in their language. However, Hoch recognizes that the “identification with *mlk* is rather weak on semantic grounds”,³⁷ but attempts to make *y-w-d-h-m-r(w)-k* represent an unknown place called “the king’s hand/monument”.²⁴ However, if, as it is argued, this represents a reference to the monument of Shoshenq at Megiddo (figure 12), rather than an unknown location, then how could Shoshenq be conquering his own monument?

Furthermore, there are common Egyptian words the scribe could have used to portray the idea of a monument to the Egyptian king, i.e. *mn.w* (Wb 2, 71.9-10) ‘monument’ and *nswt* (Wb 2, 325.1-329.10) ‘king’. Why use a transliterated Semitic name to represent an Egyptian victory monument?

The Egyptian *Wörterbuch* lexicon reveals a phonetic near match: ‘*mrk*’, meaning ‘gifts’ (Wb 2, 113.3). Attested in Hoch, *mrk* is a Semitic loan word with twelve variant spellings,

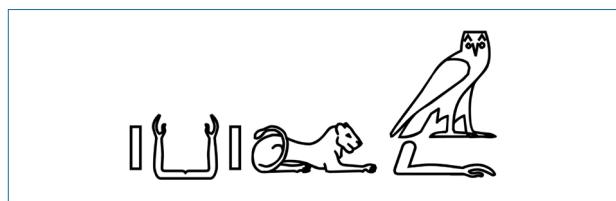


Figure 6. Hieroglyphic word ‘*m-a-r(w)-k*’ (after Hoch²⁵)

eight of which are spelled ‘*brk*’ and four spelled ‘*mrk*’, which occurs in the Berlin papyrus no. 23252 (figure 6³⁸):

Egyptologist Annie Gasse states of the form of *mrk* and its context, “its presence in this text gives it a legal connotation”³⁸

Regarding so many variant spellings of one word, Egyptologist James Allen explains:

“Even though it was often ‘written in stone’, hieroglyphic spelling was not fixed. Scribes could add or omit phonetic complements and determinatives, and some words could be written either with ideograms or phonograms. You should not expect to find the same word spelled the same way in every text, or even in the same text. No matter how they were spelled, however, the Egyptian words themselves remained the same . . .”³⁹

The version of *mr(w)k* shown in figure 6 occurs on papyrus and is closest to the Shoshenq inscription in terms of symbols used. From the context, scholars have determined its meaning: “gifts, tribute, bribes, plunder”.³⁷

Scribal economy

There are two more letters to account for—‘*m*’ and ‘*k*’. The hieroglyphs of the *y-w-d-h-m-a-r(w)-k* inscription are inscribed into a compact oval-shape. The scribe was constrained to use symbols that conform to the available area. Hence, characters were selected that took up as little vertical space as possible, but rather utilized the oval’s width. The form of *mr(w)k* used in p.Berlin-23252 would not suffice, because the ‘*m*’ ‘owl’ (𓃥) is too tall for its position within the oval. This letter can be substituted for a phonetic counterpart ‘*m*’ ‘side’ (═) (Aa15), a flat wide symbol. The raised arms glyph, pronounced ‘*k*’ (𓁃) (D28), is also too tall, and so was replaced with the laterally compressed phonetic counterpart ‘*k*’ (𓁃). Therefore, scribal efficiency and political awareness can account for the symbols used, rather than ‘foreign accents’, or ‘sloppiness’ as Hoch suggested.

If *y-w-d-h-m-r(w)-k* is to be understood as an Egyptian word rather than a transliteration of an unknown Semitic name, then Egyptians reading the Karnak list would understand *y-w-d-h-m-r(w)-k* to be referencing Shoshenq’s plundering of Judah.

However, if this inscription really does indicate Jerusalem, why does it not simply not spell Jerusalem? The reason is Shoshenq did not conquer Jerusalem! He spared the city—for Judean tribute—which is exactly what the Egyptian scribe and Scripture recorded. Egyptologist J.J. Bimson recognizes this possibility and cites Egyptologists W.M. Müller and T. Nicol, stating:

“A slightly more plausible argument, offered by Müller and Nicol, is that Shoshenq’s list includes not only cities captured in battle, but also any which paid tribute or in some other way were considered subject to him. Assuming that his protégé, Jeroboam, had asked him for protection against Rehoboam, this would have been sufficient reason for Shoshenq to include Israelite cities in his list, since Jeroboam had acknowledged some degree of dependence upon Egypt. [Bimson disagrees and continues:] While this is not impossible, it merely heightens the question as to why Jerusalem

is not included in the list, since it certainly submitted and paid tribute, although it was not conquered in battle . . .”⁴⁰

Is name ring 29 in the wrong position for Jerusalem?

If *y-w-d-h m-a-r(w)-k* does refer to Jerusalem, it doesn’t appear in the correct location on the Bubastite Portal between Hebel (no. 30), Adar (no. 28), and Megiddo (no. 27), which are located in the north. However, this question presupposes the Karnak name rings follow an orderly itinerary into the Levant. Atwood questions this, stating: “the wealth of conflicting opinions have proven that the inscription cannot be read straightforwardly.”⁴¹ Atwood highlights many semantic difficulties and concludes:

“I hope to have provided sufficient reason to readdress the phonological and epigraphic dimensions of Shoshenq’s triumphal relief so as to mitigate its uncritical employment in establishing geographical connections between it and the biblical and archaeological records.”⁴²

Atwood recognizes there are both political and religious reasons (apotropaic function, i.e. protective magic) why many Egyptologists see a straightforward comparison between the Portal and the biblical record as problematic. Not all the toponyms may have been ‘enemies’, so that “[t]heir inclusion would have been to enhance the king’s divine-like image as ruler over all forms of potential chaos.”⁴³

Furthermore, a straightforward itinerary cannot be demonstrated when the locations are compared with the name ring numbers.⁴³

My new translation of Karnak name ring 29 answers the charge of the New Chronologists, that because Jerusalem is not mentioned, Shoshenq I cannot be biblical Shishak. The most likely translation of *y-w-d-h m-a-r(w)-k* is ‘Judah’s tribute’. It was at Judah’s capital city, Jerusalem, that Shoshenq I desired Solomon’s gold, as bribe not to destroy the city.

Evidences 1) and 2) are summarized thus:

(Egyptian) *ššnq* = *ššq*
(Hebrew) *ššaq* = ‘he desired tribute’
(Egyptian) *y-w-d-h m-a-r(w)-k* = ‘Judah’s tribute’.

Evidence 4. ‘Follow the money’: treasure trail—or tall tale?

A question needs asking—what happened to Solomon’s treasure? A detective’s golden rule recognizes corruption is revealed by examining financial transfers between parties: “Always follow the money—inevitably it will lead to an oak-paneled door and behind it will be ‘Mr Big’.”⁴⁴ Shoshenq did not live long to enjoy his newly acquired wealth. Merely one year after his military campaign, Shoshenq mysteriously died. Keeping the priesthood onside, Osorkon I then gave extravagant gifts to Egypt’s temples. This was recorded just

Image: Internet Archive

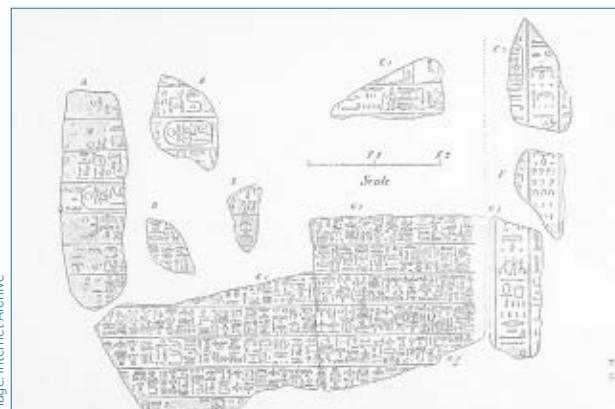


Figure 7. Osorkon I temple offerings of 383 tons of gold and silver (Naville⁴⁵, pl. LI)
Key: Ⓛ = 10; Ⓜ = 100; Ⓝ = 100,000;
= 1,000,000; = gold; = silver;
(New Kingdom *deben* weighed approximately 91 g (3.2 oz))

Image: Internet Archive

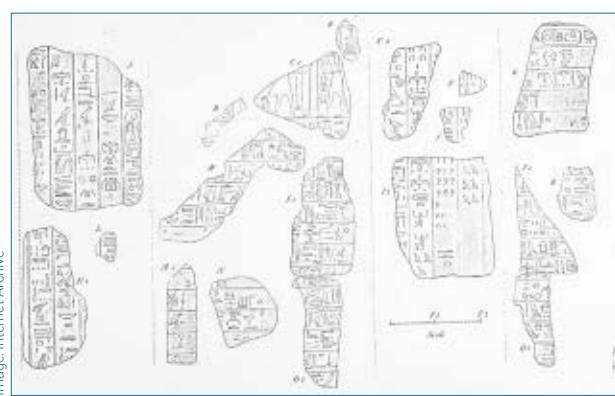


Figure 8. Osorkon I temple offerings of 383 tons of gold and silver (Naville⁴⁵, pl. LII)

three years later on a granite stele at Bubastis, in the eastern Nile Delta. The inscriptions describe Osorkon I lavishing at least 383 tons of gold and silver on Egypt's temples! (This is calculated from the surviving inscriptions, meaning there were probably more). Egyptologist Édouard Naville deciphered the weights in gold, silver, and precious stones (figures 7, 8).⁴⁵

Egyptologist Robert Ritner has translated Osorkon I's inventory, which describes, in clerical detail, his extravagant gifts to Egypt's temples.⁴⁶

“His majesty gave to the estate of his father Re-Horachty: of beaten fine gold: a noble shrine of Atum-Khepri, chief of Heliopolis of hammered fine gold: 1 statue of the prostrate king of genuine lapis lazuli: 10 royal sphinxes with offering trays amounting to: 15,345 deben of fine gold; 14,150 deben of silver [...] of genuine lapis lazuli [total: X+]4,000 [deben]. Vessels amounting to 100,000 deben, placed before Re-Horachty-Atum, ... donation amounting to: 5,010 deben of fine gold 30,720 deben of silver 1,600 deben of genuine lapis lazuli ...”⁴⁷

Ritner comments on the staggering transfer of wealth to Osorkon I:

“The preserved sums are extraordinary and likely derive in part from the spoils of his father's victorious Palestinian campaign.”⁴⁸

Furthermore, Osorkon I's son Shoshenq II, was buried in a pure silver coffin (figure 9), a facemask of pure gold (figure 10), and fabulous jewellery!

Egyptologist Kenneth Kitchen, who also accepts Shoshenq I as biblical Shishak, closes the deal:

“The vast amounts of Solomon's golden wealth may have ended up, at least in part, as Osorkon's gift to the gods and goddesses of Egypt.”⁴⁹

According to Kitchen, Shoshenq I was succeeded by his son Osorkon I in 924 BC. The account in 1 Kings 14:25–26 describes Shishak carrying off the treasures of Solomon's temple, including the gold shields. That was a lot of gold! We know how much from 1 Chronicles 22:14, describing King David amassing a staggering 100,000 talents of gold (3,750 tons!), and an unimaginable 1 million talents of silver (40,000 tons)! David described his amassing of wealth “with great pains”! Furthermore, 1 Kings 9:14; 10:10, 14, 21 describes Solomon's immense fortune, including his annual income of 666 talents (25 tons) of gold!⁵⁰ No wonder Shishak lusted after all that treasure!

Liberal scholars dismiss such biblical figures as ‘tall tales’. But, when compared to other historical accounts of national income, for instance Egypt, Babylon, and Mesopotamia, these astounding figures become the norm.⁵¹

There is also no evidence to suggest Osorkon I or Shoshenq II waged any campaigns to acquire such wealth.

The order of events is summarized thus (dates are supplied by Kitchen and are provisional):

1) Shoshenq I takes Solomon's gold as tribute from Jerusalem (925 BC). 2) Shoshenq I dies (924 BC). 3) Shoshenq I's son, Osorkon I, records 383 tons of gold and silver (at least) for Egypt's temples during the first four years of his reign (c. 924–889 BC).⁵²

It cannot be ‘proved’ that Shoshenq I's gold came from Jerusalem; but from where else, when his known itinerary took him into Judah?

Evidence 5. ‘Follow the money’: Jeroboam flees to Shishak

“... Jeroboam arose and fled into Egypt, to Shishak king of Egypt, and was in Egypt until the death of Solomon” (1 Kings 11:40).

Likely in the latter half of Solomon's reign, his officer, Jeroboam, rebelled. Scripture specifically states he fled to



Image: Aidan McRae-Thomson
Wikimedia, CC BY-SA 2.0

Figure 9. Shoshenq II's solid silver coffin



Image: Hans Olemann / Wikimedia, CC BY 2.0

Figure 10. Shoshenq II's gold face mask

Shishak (not merely Egypt). Assuming Jeroboam stayed at Shishak's court, both political leaders likely conversed widely. Details of Solomon's wealth and financial administration would naturally have arisen, details of which are given in 1 Kings 4:7–9.

This would have impressed Shishak, inspiring him to emulate Solomon's wisdom. Archaeological evidence demonstrates Shoshenq I was the first pharaoh to organize regional, monthly gatherings of tax from elected officials. No evidence discovered demonstrates this practice occurred before Shoshenq I's reign.⁵³

The Shoshenq I stela (Cairo-JE39410), discovered in 1910, housed in the Cairo Museum, reveals Shoshenq I's administrative affairs (figure 11).⁵⁴

Egyptologist Donald Redford's English translation, with commentary, states:

“... the text is arranged in twelve monthly sections ... under each are listed the officials and towns responsible for supplying the temple during that month, together with the amount of their levy.”⁵⁵

“The parallel between Sheshonq's and Solomon's provisioning systems is striking.”⁵⁶

Such evidence powerfully corroborates the identity of Shoshenq I with biblical Shishak.

However, why would Shoshenq I conquer Israel if it was governed by his ally Jeroboam? Although Scripture does not resolve this political question, the biblical writer makes clear, in 2 Chron. 12:2, that Shishak was allowed to invade because of Judah's “transgression against the Lord”. In 1 Kings 14:24 the narrator defines the sin as ‘sodomites’ who dwelt in the land. Politically, it seems that once Jeroboam succeeded to the throne, this is when Shishak broke his alliance and attacked (cf. Isaiah 36:6; II Kings 18:21).

Evidence 6. Israelite evidence of Shoshenq I

An excavation during the 1920s at Megiddo unearthed part of a victory stela raised by and commemorating Shoshenq's conquest of Megiddo, thereby independently confirming his

military incursions into Israel.⁵⁷ His hieroglyphic inscription is evident from this fragment⁵⁸ (figure 12).

The inscription reads *nfr ntr hdhprr* “good god ... white is the existence of Re” *tpnr ssnk* “chosen of Re, Shoshenq (I)”.⁵⁹ However, the stratigraphical position of the fragment is uncertain, because the fragment was used as a building block, which has raised further chronological questions.⁶⁰

Evidence 7. Libyan evidence

II Chronicles 12:3–4 records that Shishak came against Jerusalem with the aid of a huge army of Libyans, Sukkites, and Ethiopians. If Shishak had close political alignments with these countries, it would not be unreasonable to expect this. Shoshenq I was not an Egyptian pharaoh, but a Libyan, whose official title was ‘Great Chief of the Meshwesh’, referring to his Libyan tribe. However, if, as New Chronologists suggest, Shishak was Ramesses II (or III), in what way could a Ramesses claim a Libyan title and muster a huge Libyan army? Shoshenq is not an Egyptian name, but a Libyan one, whereas Ramesses is a thoroughly Egyptian name. Furthermore, as Kitchen showed,⁶¹ Shoshenq I's (spelled ‘Shashak’) titulary is recorded in the *Karnak Priestly Annals*, as “the Libyan Chief Ma”, with the ‘throw stick’ (T14) ‘foreigner’ symbol (figure 13). It would be unthinkable for Ramesses (II/III) to be recorded as a foreigner, or Libyan—they waged wars against Libya!⁶² This then is the most persuasive argument against the New Chronologists that Shishenq I was biblical Shishak and not a Ramesside king.

Conclusion

It is clear that Shoshenq I of Egypt is the Shishak of Scripture. The secular dates ascribed to this period are also reasonably in synchrony with the Bible, which strengthens its chronology.

1) Evidence for an officially recognized variant spelling of Shoshenq—*ssq*—phonetically matches the biblical name Shishak. 2) A Hebrew interpretation for Shishak is presented, meaning ‘He desired tribute’, perfectly describing his lust for



Figure 11. Cairo-JE39410 Shoshenq I administrative stela

Image: Raphaële Meffre, BIFAO 110 (2010)
Academia.edu



Figure 12. Megiddo victory stela fragment with Shoshenq I cartouche (Fisher⁵⁸)

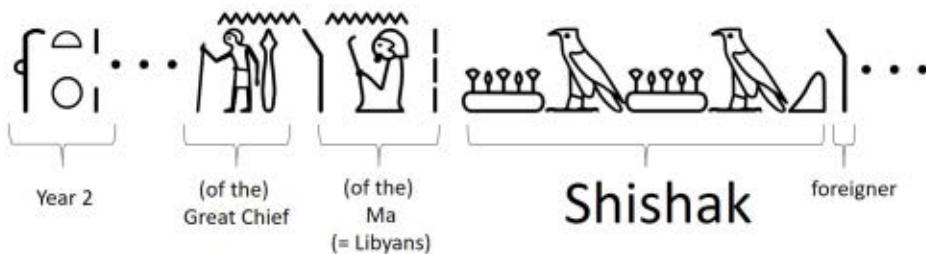


Figure 13. Karnak Priestly Annals text, Shoshenq I (spelled 'Shashaq'), with accompanying Libyan titular and throw-stick 'foreigner' hieroglyph (after Kitchen⁵¹)

Solomon's gold. 3) A new translation of Karnak inscription no. 29 is offered, meaning 'Judah's tribute'. 4) The huge wealth seemingly gained overnight by Shoshenq I's son Osorkon I, is explained by his inheriting Solomon's Temple treasure shortly after his father died. 5) Shoshenq was the first to implement monthly taxation from regional governors, likely emulating Solomon's administration. 6) Evidence independent of Shoshenq I's Karnak list, which demonstrates his military presence in Israel, comes from his cartouche, discovered on a stela fragment in Megiddo, northern Israel. 7) Shoshenq I was a foreign Libyan pharaoh, which is consistent with Shishak calling upon a vast Libyan army to attack Judah. The evidence, when combined, strengthens what Kenneth Kitchen termed 'the essential synchronism'.⁶³ Specifically:

"… in the fifth year of king Rehoboam, that Shishak king of Egypt came up against Jerusalem: And he took away the treasures of the house of the LORD" (1 Kings 14:25–26).

That biblical Shishak was Shoshenq I of Egypt is clear, and much depends upon this chronological synchrony, as Gary Bates states:

"Solomon began the temple in the fourth year of his reign which we agree was 967 BC. We believe this year to be accurate as we have built our 1 Kings 6:1 Exodus date around this as 1446 BC. This means he came to power in c. 971 BC. He reigned for 40 years. This puts the end of his reign at about 931 BC. Shishak invaded Judah in the 5th year of Rehoboam's reign meaning around 926 BC (by conventional Egyptian chronology which I believe to be reasonably accurate to within a few tens of years in some places from the 18th dynasty forward). The conventional date for Shoshenq's invasion is 925 BC. These dates are very close and this could be a wonderful synchrony with biblical chronology."⁶⁴

Acknowledgments

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The marring of creation and some implications for ecosystem functioning

Warren Shipton

God's judgment regarding human moral failure resulted in partial loss of genome stability, replication fidelity, and soil fertility. In addition, there were climate and topography changes, altered interactions between organisms, and ultimately death was experienced. Brief statements as to the nature of the changes following the Fall are given in the first nine chapters of Genesis. These alterations may be explained, at least partially, by reference to aberrations in the translation of genetic information, changes to regulatory elements, and the rare transfer of genetic information between organisms. This is not to discount the possibility of intelligent beings contributing to unsatisfactory outcomes. The curses pronounced on the earth led to changes in ecosystem functioning too. Population control now variously depends on predation, obligatory carnivorism, sanguivory, destructive competition, and devastation caused by disease and pest species. Suggestions are made concerning the phenomena operating before the Fall to ensure population control and ecological balance.

The well-balanced, very good ecosystems established at the beginning were changed following the Fall, with some alterations occurring abruptly and others developing over time, as indicated in the first nine chapters of Genesis. The possible changes experienced are suggested based on the limited information available in the inspired Word and from knowledge of ecosystem functioning today under various scenarios. Possible explanations are provided for some of the more spectacular changes recognized, such as predation, obligate carnivorous behaviour, and devices/products/organisms that function to induce pain and suffering. Possible biological and abiotic agents involved as change makers are identified.

The dynamics underpinning balanced ecosystem functioning are reasonably well understood today. In such systems, predatory/carnivorous activity, destructive competition, disease, crowding, and the impact of extreme environmental events are recognized as playing a significant role in population control. How population control was organized in the beginning, in the absence of these phenomena, needs to be addressed in order to give credibility to the Creation Model, given the assurance that all creation is dependent on sustenance provided at the hand of God (Psalm 145:15). Possible answers are provided.

Change comes

The scene that greeted Adam and Eve as creation Day 6 drew to a close was majestic and tranquil. Since they were in a special garden, we might reference the great gardens of today's world as the lowest point in our imagination. We should not think that there was a single terrestrial ecosystem in the beginning. The earth was filled with vegetation from

the third day, and a special garden was established by God (Genesis 1:11–12; 2:8). The existence of varied ecosystems might be argued to have existed from the beginning. Specialized plants capable of flourishing at different altitudes and latitudes (many species are similar) were undoubtedly created in the beginning, as they can have unique features. Furthermore, if the river Euphrates, mentioned in Genesis 2:14, corresponds even remotely with the present-day river, a number of ecosystems would have been encountered over its length. Even if this idea is disallowed, river systems require a source higher than the mouth suggesting varied ecosystem along their course.

Scripture clearly indicates that three curses fell on the earth as a result of human disobedience. Firstly, the lack of thankfulness and subsequent disobedience shown by Adam and Eve brought both direct and indirect consequences to them and to the animal intermediary used by Satan to undertake his deception. The coming birthing process was now destined to be more painful and eventually death would reduce them to dust (Genesis 3:19). The serpent also was cursed and destined to move on its belly all the days of its life (Genesis 3:14). It was abhorred in a similar manner as experienced by Cain after he was cursed. Cain was shunned (Genesis 4:11–14). The later biblical record indicates that the serpent was regarded as venomous and hence dangerous (Numbers 21:6; Job 20:16). These departures from God's ideal represented the beginning of changes (Genesis 3:17). The Apostle Paul indicates that all creation was subject to futility and corruption (Romans 8:20–21). He speaks of creation groaning under the "bondage of corruption" (v. 21, NKJV). The Greek word *phthora* used for the second descriptive term means "destruction, corruption, decay, perishing"¹ and

is applied to physical and moral decay (1 Corinthians 15:42; 1 Peter 1:4; 2:12).

The pronouncement that death would follow disobedience (Genesis 2:17) presupposes an ageing process as the event was long delayed (Genesis 5:5). Longevity has been linked to the genes possessed. A prominent theory of ageing asserts that the accumulation of mutations leads to frailty and, eventually, mortality.² God's creation was corrupted as a result of the Fall (Genesis 6:11), leading to death.

The key Hebrew word *shachath* used in the Old Testament, associated with the idea of corruption, carries the basic meaning 'go to ruin'. In its different stem forms it can mean 'spoil, ruin, pervert, corrupt' and 'be marred, spoiled'.³ The most relevant Bible examples of this are where writers used the word to refer to the perishing of a body part following damage by the (likely malicious) action of another (Exodus 21:26), and the creation of an imperfect piece of pottery by a potter (Jeremiah 18:4). Here the emphasis is on organ malfunction and on frustration of purpose that represented a departure from an ideal or goal. How this might relate in today's world can be understood by reviewing relevant information concerning selected human diseases. Rare gene variants have been identified that give rise to proteins that do not work properly. Hence, diseases such as cystic fibrosis and sickle-cell anaemia can be accounted for.⁴ The Maker's original intentions have been frustrated by the emergence of these variants. In these examples, gene replication fidelity has failed, giving rise to diseases that cause pain and other unwelcome outcomes.

Also, in Genesis 3 verse 17, there are some possible implications involving soil fertility, photosynthetic efficiency, less cooperation involving microbes, and perverse relationships between plants and insects.

The second curse followed the despicable murder of Abel by his brother Cain (Genesis 4:8, 12) and the third and final curse was associated with the universal Flood (Genesis 7). The restricted gene pool represented in the limited number of life-forms admitted to the Ark would exert longterm consequences. One such possibility might be the early elimination of some forms on account of their inability to function efficiently in a now radically changed world. If an early mutation occurred in a life-form coming from the Ark, then some very damaging consequences might follow (founder effects). Reference to current experience following major flooding events indicates several possible outcomes. The enormous upheaval experienced and the prolonged flooding would have resulted potentially in soil fertility decline that led to post-Flood nutritional deficiencies in plants and animals and occasional toxicity issues involving heavy metals. There would undoubtedly have been a change in the composition of the microbiota and even the elimination of selected microbes as experienced during prolonged flooding.⁵ Subsequent impacts on the biogeochemical cycles would



Figure 1. Galls on roots induced by *Agrobacterium* sp. after DNA transfer to the plant

Image: Microbewiki, Kenyon College Department of Biology

have followed, with the possible alteration in the balance of atmospheric gases. Other changes undoubtedly occurred.

It could be argued that one significant consequence of the Flood involved the watering arrangements on Earth. The appearance of the rainbow as a covenant sign (Genesis 9:12–15) might be conjectured to indicate that the previous watering arrangements were different in form or intensity (cf. Genesis 2:6) and changed at the time of the Flood. This would mean that the ravages of local flooding, erosion, and further disruption of soil fertility now could be anticipated.

All these changes would have impacted food chains and web functioning. Further, the movement towards the emergence of pathogens, thorns, thistles, venoms, predation, carnivorism, and sanguivory would have been witnessed among organisms capable of feeling pain. The latter three phenomena were accentuated post-Flood. We can reasonably argue that all organisms in the Ark survived on a plant-based diet during their trip. Undoubtedly, some animal groups became extinct after the Flood on account of resource limitations.

Change makers

A number of agents can be considered to have facilitated some of the changes that occurred post-Fall. These could have involved both abiotic and biotic components. The Curse spoken by God can be seen as an act allowing changes to happen in a radically different world. From our knowledge of the many heritable changes recognized today,⁶ there is an expectation that some genotypes would have flourished whereas others might have been stressed, as they were

now functioning outside their optimum operational design parameters.

A role for human participation in change is also inferred. The first change noted at the hand of humans was desensitization to other humans (Genesis 4:8; 6:5). Domestication of selected animals and interbreeding experiments can be imagined. In such endeavours they selected for desirable phenotypic characteristics, which are considered to be a reflection of changes in regulatory gene activity and mutations.⁷ For instance, the production of the mule (e.g. Genesis 36:24; 2 Samuel 13:29), involving a male donkey and female horse cross, gave desirable characteristics coming from both parents.⁸

The biblical record indicates that Adam needed to cultivate the soil (Genesis 3:17, 23). Some of the plants he chose may have included the progenitors of wheat and barley, as they are known to have originated in the Fertile Crescent. It is well understood that some plant derivatives have arisen through the selection of phenotypic variants with desirable characteristics.⁹ Spectacular gene rearrangements have been undertaken in recent years involving both plants and animals.¹⁰

Adverse intelligent agencies could have been involved in changes occurring in nature. This possibility is often not considered, but Alvin Plantinga, the American philosopher, is one who has suggested this, as the following quote indicates.¹¹

“The world may very well contain sin and suffering, not just on the part of human beings but perhaps also on the part of other creatures as well. Indeed, some of these other creatures might be vastly more powerful than human beings, and some of them—Satan and his minions, for example—may have been permitted to play a role in the evolution of life on earth, steering it in the direction of predation, waste and pain. (Some may snort with disdain at this suggestion; it is none the worse for that.)”

The story of Job’s distressful experience with boils (Job 2:4–7) indicates something of the skill of Satan in the manipulation of nature post-Fall. Job did not know the back story, which paints Satan as having control of the physical and biological realm within limits permitted by God (Job 2:6–7). It is not beyond reason that genetic manipulation could have been permitted within limits specified and inferred in Genesis 3 and possibly 9 (the fear factor mentioned may have indicated the development of carnivorism).

Interactions among organisms can lead to changes in the genetic complement held in a cell. Transfer of genetic information can occur occasionally through processes other than sexual reproduction, and this can lead to changes in the characteristics displayed by an organism.

Genuine evidence for gene transfer among organisms is suggested by some well-researched examples. The classic

example involves the bacterium *Agrobacterium* and related bacteria. These are well-known for their ability to transfer plasmid DNA (small, circular, double-stranded DNA molecules not part of chromosomal DNA) to selected living plants in the natural environment. The plasmid DNA from *Agrobacterium* can be integrated into the chromosome of selected plants. There, the foreign DNA will cause tumour-like growths (figure 1), even in the absence of living bacteria.¹²

Bacteria are able to transfer genetic information between bacterial species and genera (horizontal gene transfer) on a regular basis through the operation of well-known mechanisms (conjugation, transformation, and transduction) of which phage (bacterial virus)–mediated transduction is significant. Such transfer frequently involves genomic islands and also plasmids that confer antibiotic resistance.¹³

Other organisms can be involved in gene transfer. For example, the transfer of DNA between a bacterium (*Escherichia coli*) and a yeast (*Saccharomyces cerevisiae*—single-celled eukaryote) has been recorded in culture.¹⁴ It is conceivable that related events could occur in natural situations, such as in biofilms. It is important to note that the organism receiving the new information is still abundantly recognizable and it is not transformed into something different; evolution as viewed by modern science is not illustrated in these examples.

Genome changes give unwanted outcomes

With the passage of time, remarkable changes were seen among the plants and animals. Disease, predation, the development of omnivorous and carnivorous lifestyles, and destructive competition were observed together with the appearance of noxious plants and animals. Relatively straightforward explanations can be given for some of these developments, while others require a more complex approach. A number of examples will be given to explain the emergence of altered biological capacities in members active in the food web. This does not exhaust the spectrum of possibilities operating in the biological world.

Carnivores and omnivores: specialized features

The order Carnivora includes a number of species. Some are obligate carnivores (felines or cats), while most of the remaining members are omnivores, consuming variable amounts of meat and vegetable matter.¹⁵ A number of anatomical features have been associated classically with carnivorous animals. They have specialized teeth. The canine teeth (long, sharp, and well formed) vary the most, and such variability can be seen in populations in confined geographical locations. The differences noted are considered to be accounted for by developmental factors (e.g. diet)

as well as selective pressures.¹⁶ Some of the features give advantages in catching and dissecting prey (teeth, mouth structure, claws), but others such as the organization of the digestive tract, may have little to do with its potential to handle vegetable matter if the missing digestive functions were present (refer to the giant panda example discussed later).

Obligate carnivores (felines) have lost the ability to synthesize selected amino acids and cannot synthesize adequate quantities of vitamin A and arachidonic acid. They show low activity in some intestinal synthetic enzymes and an inability to taste sugars.¹⁷ In poorly functioning biochemical pathways delivering low levels of activity, output levels can be increased by changes to regulatory genes. Where an activity has been lost, some suggestions have been made as to how this might have happened.¹⁸ Loss of activity drives animals to seek alternative, satisfying food sources as illustrated in vampire bats (figure 2). They have lost various functions (10 suggested) through inactivating mutations leading to obligate blood feeding. One mutation led to extensive morphological and physiological changes to the stomach.¹⁹

With omnivores, loss of metabolic capabilities does not generally occur. Bears (family Ursidae) generally are able to exist satisfactorily on a well-balanced vegetarian diet. Some extinct members were entirely vegetarian with appropriate adaptations to suit the particular specialized diet. The variation seen today is a reflection of selection among the options present in the genome of the animals held in the Ark.²⁰ A fascinating member of the family Ursidae is the giant panda. It has a digestive tract, digestive enzymes, and gut microbiota that show a strong resemblance to those found in the carnivores. The explanation for this seems to reside in the similarity shown between the protein to non-protein energy ratio in the diets of both. On the other hand,

pandas have skull, jaw, and dentition that resemble those of herbivores. In addition, they have lost a functioning taste receptor often associated with meat eating.²¹

Taste loss is widespread in carnivores. The carnivores that are exclusive meat eaters are unable to sense sweet-tasting compounds, due to a defective receptor. The giant panda lacks the functional gene for savory taste (umami receptor). The presence or absence of particular functional receptors (loss of gene function mutations) appears to be related to food preferences. This means that bears that feed on berries have an intact sweet-taste receptor.²²

Venoms

Venoms are natural substances secreted by some organisms that are injurious to health in small amounts when introduced, usually via a bite or sting. Venoms are widespread in nature and have a toxic effect on selected body systems (e.g. neurotoxins, cytotoxins). Several examples will be taken to illustrate how some damaging poisons may have originated. By giving these examples, it is not inferred that no toxic materials were present pre-Fall. A planned role for toxins might be demonstrated by taking one example. The role of toxin genes in the simpler life-forms, such as soil- or water-dwelling bacteria, is presumably to facilitate their survival and growth there and need not be connected with disease in those environments. This appears to be the case with *Bacillus cereus*, a soil-dwelling bacterium that lives happily with invertebrate hosts. The ability of this organism to grow in food items permits it to cause diarrhoeal disease in humans through its toxin-producing capacity.²³ Changes in human activity patterns since the Fall are responsible for the occurrence of this type of food poisoning.

If death-dealing toxins were part of the original design experience for feeling life-forms, we would need to assume that most animals and birds possessed toxin immunity in the beginning. While immunity exists to a limited extent today,²⁴ the proposition of an almost complete reversal in the living arrangements of animals does not appear to be a viable one.

With snake venoms, it has been postulated that some venoms may have arisen from non-toxic genes that performed a number of cellular tasks around the body. Highly venomous snakes appear to have many more copies of the venom genes than do non-venomous snakes (pythons). The theory underlying this proposal suggests that the proto-venom genes were first expressed at low levels in many tissues, including the oral secretary glands, and this was followed by higher expression levels for some genes in these glands and a small number of other tissues. To enable these changes to occur in saliva, gene duplication and further mutation in one of the duplicated DNA strands could have occurred, and exon shuffling may also have been involved.²⁵ Increase in the expression of venom genes can also be theoretically linked

Image: Mokele/Wikimedia,CC BY 3.0



Figure 2. Skeleton of vampire bat, showing piercing teeth thought to have originally functioned to pierce fruit

to suggested changes in the regulatory sequences of genes.²⁶ Certainly, creationists can resonate with the idea that proto-genes may have been present from the beginning where they served useful design purposes, and that gene duplication and other targeted changes occurred following the Curse to allow the functioning of the now altered ecosystem.²⁷

Thorns and prickles

Thorns are modified branches, while prickles are modified outgrowths from epidermal cells (figure 3). Thorns and prickles protect plants from excessive herbivory.²⁸ It seems possible that some population control measures were lost following the Curse, leading to high levels of herbivory from insects and mammals. The appearance of these structures would have functioned to offer some protection.

Prickle formation also has been recorded with eggplant crosses. Those formed between the diploids *Solanum aethiopicum* and *S. macrocarpon*, which lack prickles, led to prickle formation in the F1 hybrid. Also, crosses between the diploids *S. macrocarpon* and *S. melongena* led to prickle formation in some F2 hybrid progeny.²⁹ These plants had gained the ability to produce prickles in contrast to their assumed original state in Eden. A possible explanation is offered by a study of a spontaneous mutant involving *S. vivarum*. The change was from the prickly state to a prickle-free one. The biosynthetic pathways differed in the prickle bearing and prickleless variants and, significantly, the genes involved in the prickly variant were related to stress and defence responses.³⁰ In yet another plant (prickly poppy), experimental elevation of prickle density has been shown to be related to hormone levels,³¹ again pointing to the significance of biosynthetic pathway regulation. Hence, it seems evident that regulatory alterations could be primarily responsible for prickle development. This idea is strengthened by recent work with roses. Changes in regulatory pathways were indicated as operating in leaf trichome (outgrowth of epidermal tissues that function in defence; they represent fine and smaller outgrowths in contrast to prickles) formation and other features.³²

In citrus, thorns develop on account of thorn stem cells experiencing arrested growth on account of the activity of two regulator genes. When the activity of these genes is disrupted (induced mutations to the recessive state), the thorns develop into new branches instead.³³ Here again, regulatory changes were key to thorn appearance.

An incompetent God?

The mere existence of carnivores has brought forth the accusation that a loving and omnipotent God would not have allowed such suffering and carnage to exist.³⁴ Those

attempting to resolve the issue might reject the idea of God or embrace the concept of progressive creation through the evolutionary process. An alternative is to contend that the outcomes observed today came as a consequence of the moral failure of the progenitors of the race. Such failure and subsequent ones had consequences for the entire biological realm through alterations in the expression of the genetic code in a vastly physically changed world. In the beginning, there was no need for carnivory in order to control population growth. The Creator had a well-defined strategy that did not involve suffering and pain (Genesis 1:31; Isaiah 65:25; Revelation 21:4).

Several options have been outlined by John Morris; namely, features were present originally (maybe benign) that would later be needed—the genome contained the potential to be changed by the forces of nature and by selection to give rise to carnivory (organism designed to suit environmental conditions as a function of survival variability) or the sinister forces of evil led by Lucifer were somehow involved.³⁵ In the study of ecosystems of isolated islands devoid of mammalian predators, a situation is observed somewhat resembling the stability envisaged in the beginning.³⁶ In such situations, mammalian predatory activity is unnecessary for the maintenance of population balance. It is true that in some of these situations losses and gains of species may be experienced due to pressures of food supply or to predation by invertebrates (e.g. centipedes),³⁷ but a dynamic equilibrium occurs over time.

Well-balanced components of vegetation were established initially to cover the earth (Genesis 1:11–12), with the planned starting fauna added later (vs 24–25). The fauna seeded into the existing ecosystems were meant to multiply, meaning that there would have been a succession as they spread throughout the terrain. Finally, a homeostatic state would have been reached in the absence of mammalian predators. Once this state had been attained, its continuance would have been dependent on population control.

Population control mechanisms

The actual number of offspring produced (fertility) and natural ability to reproduce (fecundity) has profound effects on the survival of plants and animals. In the beginning, these features were designed to enable population increase to occur in a planned manner throughout the various ecosystems existing. In the beginning, it can be anticipated that there were multiple dispersal centres, represented by different ecosystems, that were seeded with animals, birds, and other life-forms at creation (multiplication was mandated, Genesis 1:22). This would have ensured the functioning of the ecosystem moving towards the planned final state. Nevertheless, in order to reach this state, a succession

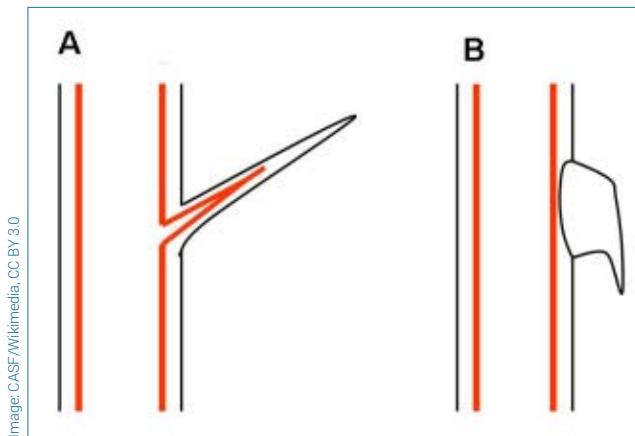


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Figure 3. Illustration of a thorn or modified branch (A) contrasted with a prickle with no vascular connection (B)

conceivably occurred as the creatures spread out and occupied virgin vegetated terrain. At some point, reproductive activity in the fauna would necessarily have been slowed to achieve the balance planned and then terminated as, with no death as an option in feeling organisms (how life and death are viewed biblically may differ among creationists), overpopulation would have become an issue. Substantial changes in the physical environment, either seasonally or with the passage of time, are not thought to have occurred.

The colonization of the post-Flood earth would have been entirely different from that experienced in the beginning. There was one centre for dispersal after the Flood. Post-Eden dampening of population growth would have occurred via the (now) natural death process and through changes in the other biological events, involving disease and predation and due to anticipated upheavals in the physical environment. Fertility and fecundity issues would have been one of the first noticeable changes taking place post-Flood. Population numbers are determined by numerous factors, including food quality and quantity, physical environment, biological interactions, the nature of the genetic code, population structure, disease, and innate drivers. Most of the factors known today that influence population increase would not have been operational in the beginning. For example, diseases, ageing, mineral deficiencies, and environmental chemical contamination were unknown. Today, these factors influence fertility and, ultimately, population growth.³⁸ Both density-dependent and -independent factors influence population levels, and their significance varies with the biological entity under consideration.

Population density in resource-limited situations influences the fecundity of animals.³⁹ Density-dependent processes are found with predation, parasitism, resource competition, and other interactions. Apex predators are significant in the regulation of populations of various animals

in some ecosystems. For example, in Ghana the rise of the baboon population to plague levels can be accounted for by the decrease, and sometimes disappearance, of lions and leopards in selected parks.⁴⁰ On the other hand, invasive predators (e.g. cats, rodents, dogs, and pigs) have been responsible for the extinction or precipitous reduction in populations of birds, mammals, and reptiles in other geographical locations.⁴¹

The social environment of some animals induced by crowding can impact their reproductive behaviour through alterations in brain function so that self-regulatory strategies are operational.⁴² It is contended that in a stable, complex ecosystem intraspecific competition and self-regulation is always present.⁴³ In reality, the interplay of mechanisms involved in density-dependent population fluctuation has been difficult for scientists to identify fully.⁴⁴

Density-independent regulation occurs commonly through the operation of abiotic factors, such as extremes in environmental parameters.⁴⁵ This can lead to abrupt shifts in population levels rather than the dampening effects classically seen with density-dependent regulatory events. This was observed during the deadly bushfires in Australia in 2019/2020.⁴⁶ The effects exerted by stressors may be more subtle, as illustrated in the life cycle of Chinook salmon. Juvenile survival may be affected not only by water temperature but stream flow.⁴⁷ With epiphytic plants, density-independent factors can be significant in determining population dynamics in a canopy as, for instance, light, moisture, and nutrient availability, levels of turbulence and radiation, and gas concentrations.⁴⁸ There is no good reason to suggest that similar factors influenced population dynamics in the beginning.

In the pre-Fall environment, some food resource competition conceivably developed for selected life-forms, particularly in tree canopies and the transition area between ecosystems. With fish breeding, as found in spawning habitats today,⁴⁷ the quality of the habitat could have influenced egg incubation success. A breeding hierarchy possibly existed with selected animal groups that may have influenced population increase. Self-regulatory behaviour could have been a dominant feature. Ultimately, there would have been a need for fundamental changes in population increase expectations over time in ecosystems where death and pain were not experienced. Conceivably, this could have occurred through changes to the gene regulatory network organized by the Designer in line with the concept of His continual sustaining activity (Hebrews 1:3; cf. Genesis 18:10–11, 14; 21:1–2). It is noted that, from plants to mammals, changes to the gene regulatory network can have dramatic effects on reproductive output so that increases, decreases, and even no output have been observed.⁴⁹ Changing the regulatory

setting represents a rather straightforward option to the human mind.

Conclusions

The changes that occurred in the biological world following God's judgments on account of human moral failures and rebellion have resulted in substantial alterations in ecosystem functioning. All forms of life have been impacted negatively on account of operational aspects of their biological machinery being upset. Both abiotic and biotic agents have been involved in inducing changes in the expression of genetic information, leading to some unusual outcomes. Some of these were predicted in Scripture and can begin to be explained in scientific terms. Some of the most untoward results involved the appearance of disease, predatory activity among larger life-forms, pain-inducing thorns, prickles, and venoms. These outcomes now contribute towards population control in a world where death is a familiar phenomenon. Density-dependent and -independent mechanisms of population control are now familiar. In the pre-Fall world, some of the milder forms of population control recognized today conceivably existed with self-regulatory phenomena perhaps predominating. At some point, in the absence of life-forms returning to dust, additional population control mechanisms involving reproductive ability would have been necessary. This might have involved changes to the gene regulatory network, or other options might have been planned.

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The igneous origin of salt deposits and structures

Stef J. Heerema and Gert-Jan H.A. van Heugten

It is strange that Blom published his theistic evolutionist view on the origin of salt deposits in *Journal of Creation* (JoC).¹ All the more curious is the fact that he disqualifies his own paper on his website. He writes²: “The JoC is of poor quality, even by creationist standards” (translated from Dutch). Furthermore, he disregards the JoC’s peer review process³: “the pool of potential JoC reviewers does not contain qualified salt geologists. One could imagine that this results in a rather superficial review process.” Finally, he notes that his “suggestions for a creationist salt model”, as suggested in his paper, will not work.³ That last point is true.

In his paper, Blom disputes the igneous origin of salt deposits that was published in JoC.⁴ Instead, Blom defends a sedimentary, cold-water origin of salt deposits. He argues that after the slow deposition of the overburden, salt structures formed by means of solid-state salt flow, with these processes taking place over millions of years. Blom, and all other evolutionists with him, have to believe

that *solid* salt flows like a fluid.⁵ However, field and seismic observations suggest a rise of *liquid* salt within a *fluidized* overburden (e.g. figure 1). The internal friction of the solid salt and the drag forces applied by the solid top and sublayers—which are beyond description and without a driving force to overcome them—are neglected by Blom. The problems with synchronous flow of the solid sedimentary rock are also ignored. That allows him to embrace a theoretic model that focuses on rising salt pillars only, while disregarding the simultaneous displacement of sedimentary rock.

Liquid, not solid

Blom’s salt pillar model begins with the sudden appearance of a three-km-deep and three-km-wide graben in the overburden.⁶ Figure 2 shows the graben formation he advocates. In a miraculous way, the underlying salt and the subsalt rock stayed undisturbed in the process of graben forming. With Blom’s supernaturally formed graben in place, the differentially loaded overburden delivers the driving force for the salt to move. Although the solid overburden rests upon the solid salt, Blom falsely believes that the salt layer can move without displacing it. Figure 1 shows a lateral displacement of salt of hundreds of kilometres. These enormous horizontal movements and the time path involved are neglected. Blom focuses on the rise of the vertical pillar only. Surprisingly, he uses the *observed* behaviour of viscous fluids to calculate *unobserved* movement of solid rocks over millions of years. He calculates that it took one million years to form a 500-m-tall NaCl pillar. To speed up the theoretical framework, Blom advises YECs to assume the salt had a high water content as that lowers the viscosity of NaCl. However, salt is among the driest rocks on Earth. That is despite the fact that most of

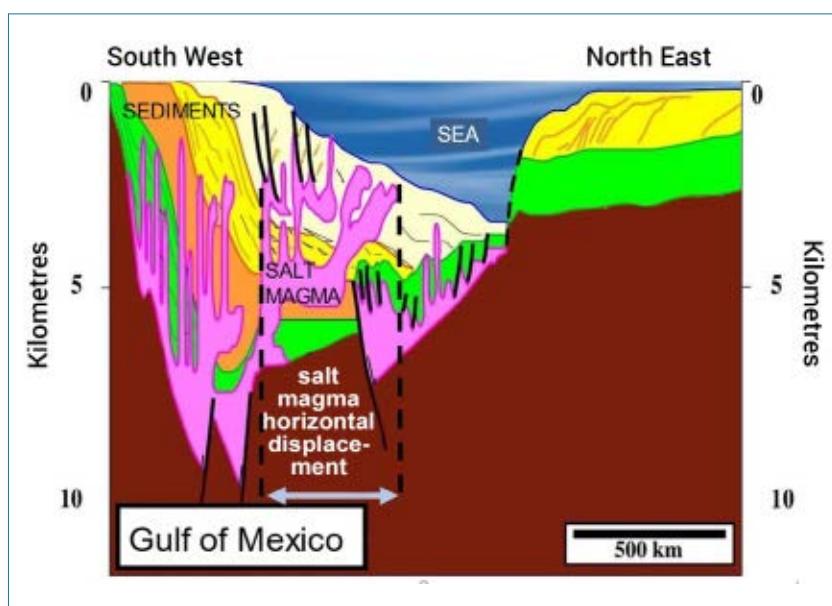


Figure 1. If this salt structure was formed in a solid state in between solid sedimentary rock, the overlying rock should have been pushed up into mountain ranges above the salt pillars. However, these underwater ridges have not been formed. The dotted lines show the horizontal displacement of the salt. Only a salt magma could have flowed several hundred kilometres horizontally in between Flood mud. Solid rock doesn’t flow and, even if it did, it would require a timescale that far exceeds the biblical age of the earth. Thus, the resulting salt structure plus the sedimentary rock which surrounds it were in a liquid state when this took place.

the rock salt is situated below ground water level. So Blom's advice seems pointless.

Blom also advises creationists to consider that large tectonic forces during the Flood could have enhanced solid-state flow of salt. This is another dead end as the Flood *mud* can't supply the necessary large tectonic forces to shape *solid rock* salt. Also, salt exhibits viscous behaviour that leads to the slow plugging of mine galleries and caverns. But deformation at higher velocities by greater deviatoric stresses from large tectonic forces leads to rock salt fracturing—a process that is called 'dilation' and destroys the impermeability which salt layers are known for.⁷ Thereby, it is likely that the waters of the Flood would have dissolved the salt layers after the disintegration of the polycrystal structure occurred. The water would certainly not have deposited it again as impermeable dry salt giants.

Anhydrite is also a big part of salt pillars. Figure 3 shows an example. Anhydrite is not known for its ductile behaviour. It is called non-ductile.⁸ Therefore ductile behaviour does not seem to explain the existence of salt pillars.

False suggestions

Another inaccuracy in Blom's paper is that salt pillars are considered less dense than the overburden. He writes: "If the average density of the overburden is higher than the density of the salt (which is $2,200 \text{ kg/m}^3$ or even lower⁹), the salt will even reach the surface and spread out." He believes that salt pillars consist mainly of NaCl ($2,160 \text{ kg/m}^3$). The higher density salts such as anhydrite ($2,970 \text{ kg/m}^3$), which make up a significant portion, are ignored. Figure 3 shows an example where anhydrite in fact contributes about 50% to the total salt mass. Other salts, like polyhalite ($2,780 \text{ kg/m}^3$), dolomite ($2,840 \text{ kg/m}^3$), and aragonite

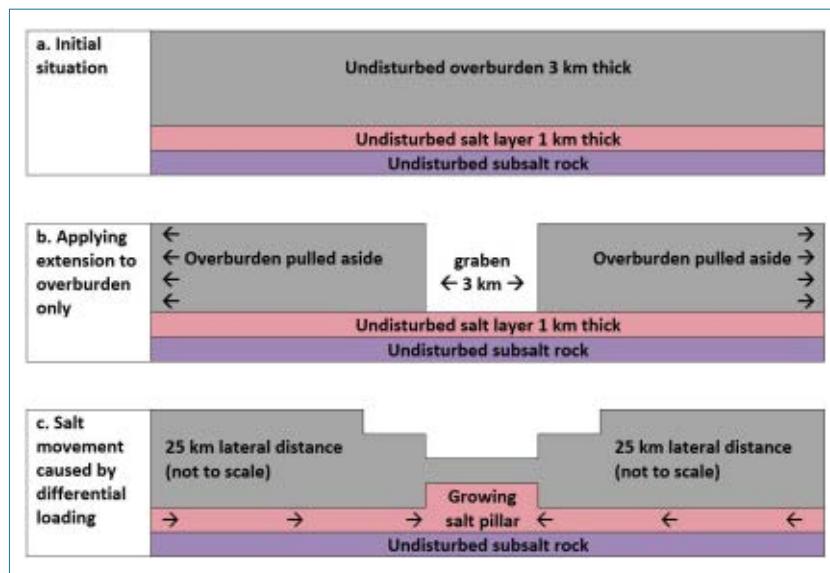


Figure 2. The undisturbed salt and subsalt layers in Blom's model show that the displacement of the overburden (from a to b) is unlikely and would not have affected the salt and subsurface layers. So, there must have been an external force that applied extension to the overburden only. By some unknown mechanism this force was able to overcome the shear stresses to create a graben 25 km away. It is highly unlikely that these types of geologic forces existed. Thus, situation b will never occur. Thereby, step c is also highly improbable, as not only would the walls of the graben have collapsed, the entire overburden would most likely also have been carried away into the graben by the moving salt. Despite these problems, Blom starts with situation c (to do the maths in his calculation) as if they did not exist.

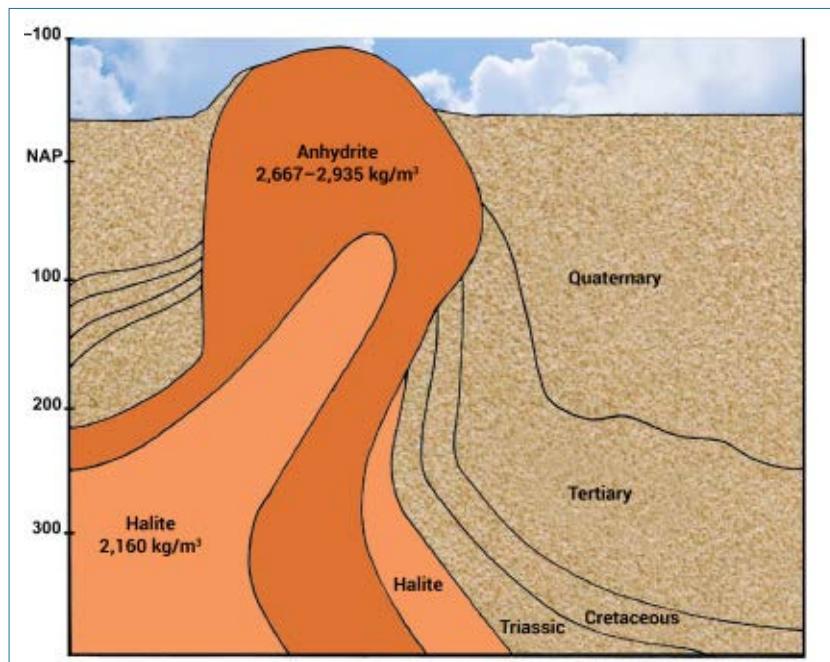


Figure 3. Salt profile at Segeberg, Germany (depth in metres below sea level). Anhydrite is one of the salts that contributes significantly to the average density of salt pillars. This shows that salt diapirs can be denser than the overburden. The overburden typically shows densities of $1,200\text{--}1,400 \text{ kg/m}^3$ in near-surface positions,¹⁰ increasing to $2,100 \text{ kg/m}^3$ at a depth of 500 m. The latter, and the given densities, are estimated on the basis of a density study carried out on similar strata in the Netherlands.¹¹

(2,930 kg/m³) contribute to the overall density of salt layers worldwide as well. Also, salt is usually an impermeable material with a porosity of less than 1%.¹⁰ Sedimentary rock, however, has high porosities up to 40%, which lowers the density significantly.¹¹ These higher porosities allow many sedimentary rocks near salt structures to hold immense reservoirs of fossil fuels. Gases and liquid oils typically have a lower density than the water originally present in these pores.

Blom advises YECs to consider the serpentized lithosphere instead of long-lasting evaporation as a salt source. But the serpentization process is just another long-lasting process that will not fit in any biblical creation model. We addressed the problems recently and concluded: “Even from a secular point of view, it seems a stretch to try and use serpentization to explain salt giants.”¹²

On his website, Blom writes: “I think the standard evaporation model is just too well supported by the facts. ... I don’t think there is a creationist salt model that will ever fully work.” This shows that his suggestions to creationists are in fact misleading. He holds to slow desiccation, driven by solar energy. It is remarkable that he ignores the growing group of geologists that argue against it. They do so for good reasons. Scribano *et al.* conclude: “the evaporite model hardly explains deep-sea salt deposits.”¹³ For example, they list difficulties with the sequential deposition and the relative amounts of different types of salt. Also, Oard hints at an igneous origin for limestone, dolomites, and anhydrite.¹⁴ These ‘salts’ are also commonly found in salt giants.

It is good news that evolutionists are looking into creationist thinking on the origin of salt. But it can be concluded that Blom’s vision is of little value.

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Evolutionary misogyny: anthropometry and women's inferiority

Jerry Bergman

The view that women were less intelligent than men, and inferior in other ways, because they were less evolved, was inspired by Darwin. It was widely accepted in academia, including by many of Darwin's leading disciples. Anthropometric measurements of the skull were used to attempt to 'prove' this idea by showing that women had smaller brains. This idea had a profound negative effect on women's progress, educationally, socially, and economically.

Anthropometry, the scientific study of comparable measurements and proportions of the human body, has historically been abused to justify Darwinism. This review focuses on its abuse to argue for the mental inferiority of women based on the theory that they are less evolved. In Europe, anthropometry "dominated the human sciences for much of the nineteenth century and remained popular until intelligence testing replaced skull measurements as a favored device for making invidious comparisons among races, classes and sexes."¹ The most important means of 'proving' female inferiority was *craniometry*, a subset of anthropometry involving measurements of the skull.

Paul Broca's important contribution to the movement

Of all anthropometric measurements, the academic field of craniometry "commanded the most attention and respect."² The unquestioned leader of this movement to find 'scientific' confirmation of the supposed inferiority of women in this way was Paul Broca (1824–1880; figure 1). He was a leading professor of surgery at the Faculty of Medicine in Paris. Broca gathered a school of disciples and imitators around himself, consequently influencing the entire scientific community. Their scientific work was very "meticulous and apparently irrefutable, exerted great influence, and won high esteem as a jewel of nineteenth-century science."³ Despite the movement now being widely discredited, Broca's fame still remains via Broca's area of the brain. This is a location in the frontal lobe of the dominant brain hemisphere, usually the left one, which is linked to language processing and speech production.

The 'inferior female brain' idea from Darwin

In response to the question 'Where did the idea that women's brains are inferior come from?', British neurobiologist Dr Gina Rippon answered, "This goes all the way

back to Charles Darwin, who said that women are inferior because they have inferior brains".⁴ Rippon documents this claim in detail in her 2019 book on the subject:

"Among the intellectuals of the day [the 1800s], there were continuing concerns about the 'women question', [in response to] the increasing demands from women for rights This feminist wave served as a rallying call for scientists to provide evidence in favour of the status quo, and to demonstrate how harmful it would be to give power to women—not only for the women themselves, but for the whole framework of society. Even Darwin himself weighed in, expressing his concern that such changes would derail mankind's evolutionary journey. Biology was destiny and the different 'essences' of men and women determined their rightful (and different) places in society."⁵

She added that "Brain size was an early focus in this campaign to prove the inferiority of women and their biology. The fact that the only brains that researchers had access to were dead ones did not stand in the way of trenchant brain-based observations on women's lesser mental capacities ... ".⁶ This claim was repeated as late as 1927 in a book titled *Women: The Eternal Primitive*.⁷ The author, William Fielding, wrote that "In the pathological state, such as insanity, she tends to be more intractable, more descriptive—representing a more complete reversion to aboriginal life, or [evolutionary] ancestral type."⁸ He added that women's "chief disadvantage in the struggle for existence as it evolved ... is the fact that she is subject to periodic incapacity in performing her functions as the mother of the race ... womankind possesses an inherently primitive disposition."⁹

Acknowledging Darwin's contribution to sexism

In 2021, Darwin's sexism was finally acknowledged, by a Princeton University professor, in the most esteemed science journal in the world, aptly titled *Science*. The author, Agustín Fuentes, wrote that some of Darwin's sexist "assertions

were dismally, and dangerously, wrong. ‘*Descent*’ [of *Man* is a book] … not to venerate” as is common among many evolutionists today.⁹ Fuentes writes that, despite

“… some innovative inferences, [Darwin’s book] ‘*Descent*’ is often problematic, prejudiced, and injurious. Darwin thought he was relying on data, objectivity, and scientific thinking in describing human evolutionary outcomes. But for much of the book, he was not. ‘*Descent*’, like so many of the scientific tomes of Darwin’s day, offers a racist and sexist view of humanity.”⁹

Fuentes concluded that Darwin, in his book *The Descent of Man* (figure 2),

“… identified women as less capable than [white] men, often akin to the ‘lower races’. He described man as more courageous, energetic, inventive, and

intelligent, invoking natural and sexual selection as justification, despite the lack of concrete data and biological assessment. His adamant assertions about the centrality of male agency and the passivity of the female in evolutionary processes, for humans and across the animal world, resonate with both Victorian and contemporary misogyny. … Darwin was a perceptive scientist whose views on race and sex should have been more influenced by data and his own lived experience. But Darwin’s racist and sexist beliefs, echoing the views of scientific colleagues and his society, were powerful mediators of his perception of reality.”⁹

One example of sexism is Darwin’s conclusion that women were at a “lower level of development” than men, due to their “earlier arrest of individual evolution”. Darwin and many other evolutionists of the time believed that, because women had smaller brains, they were “eternally primitive” and childlike, less spiritual, more materialistic, and “a real danger to contemporary civilization”.¹⁰ Darwin reviewed historical proof that supported his view that women were inferior to men.¹¹

Ironically, Darwin’s daughter Henrietta was one of the main editors of Darwin’s *Descent of Man* book. Some Darwin scholars speculate that Darwin’s original words were toned down by Henrietta when she edited the book. Furthermore, these ideas are surprising in view of the fact that Darwin had extensive correspondence with many intelligent, educated women, as documented in a 270-page collection of a select sample of these letters.¹²

Darwinist ideas were critically important in developing and maintaining sexist ideas in society as a whole. Darwin’s writing was an especially important influence on sexism because it is uncontested that Darwin’s ideas had a profound influence on the entire academic and scientific world. In fact, “‘*The Descent of Man*’ is one of the most influential books in the history of human evolutionary science.”⁹

As noted, leading evolutionists have finally openly acknowledged the fact that Darwin influenced the sexism that developed after the biblical foundation of the equality of the sexes was undermined. That one of the world’s leading scientific journals, *Science*, has acknowledged Darwin’s major contribution to this problem will help open the door to others to publicly document this fact.

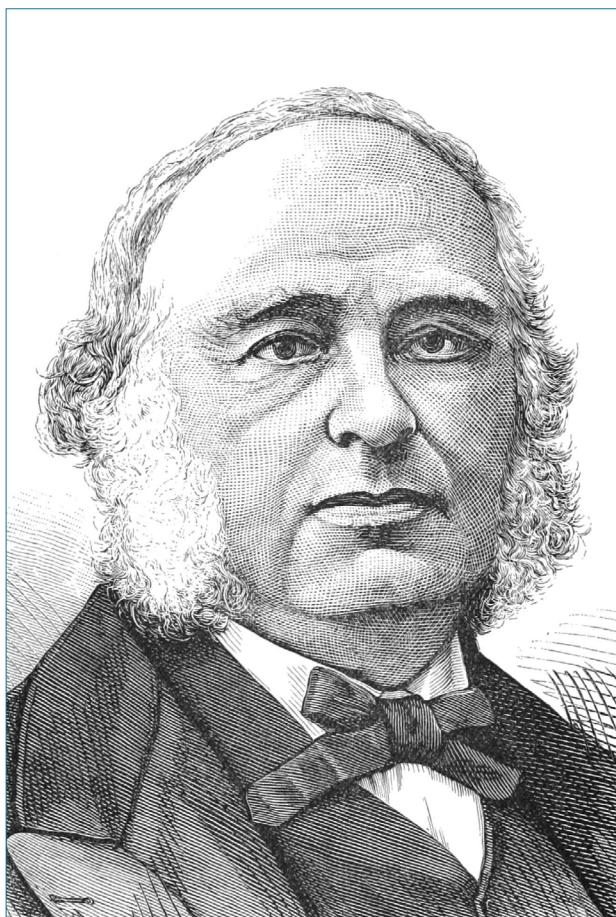


Figure 1. Paul Broca was one of the most respected anatomists of the last century. Consequently, his beliefs about women were very influential in science. In 1848, he founded a free-thinker society and was an active supporter of Charles Darwin. He is famous for stating “I would rather be a transformed ape than a degenerate son of Adam.” (Memoir of Paul Broca, *J. Anthropological Institute of Great Britain and Ireland* 10:242–261, 1881.)

Many leading Darwinists followed Darwin

The contribution of Darwin to the denigration of women is well known. Less well known is the fact that many leading Darwinists were as aggressive as Darwin, if not more so, in defending the position that women were intellectually inferior

to men. One example is George Romanes (1848–1884; figure 3). He was the youngest of Charles Darwin's academic co-workers, and therefore his evolution opinions are historically important.¹³ Romanes became Darwin's research assistant during the last eight years of Darwin's life. His work for Darwin was essential to Darwin's compiling the information required for his later books.

Romanes, the man who said he 'venerated' Darwin,¹⁴ had been a Christian, but became an agnostic due to Darwin's influence.¹⁵ Some, including Romanes' religious wife, claimed he (Romanes) regained some of his religious belief during his final illness. Just before his untimely death at age 46, Romanes published an important three-volume work titled *Darwin and After Darwin*.¹⁶

Romanes' views on women

Romanes concluded that the main difference between men and women concerned their mental faculties of intellect, emotion, and will.¹⁷ The rationale he used to justify this view was as follows:

“... the average brain-weight of women is about five ounces less than that of men, on merely anatomical grounds we should be prepared to expect a marked inferiority of intellectual power in the former [women]. Moreover, as the general physique of women is less robust than that of men—and therefore less able to sustain the fatigue of serious or prolonged brain-action—we should also, on physiological grounds, be prepared to entertain a similar anticipation. In actual fact we find that the inferiority displays itself most conspicuously in a comparative absence of originality, and this more especially in the higher levels of intellectual work.”¹⁸

He added that the intellectual difference between males and females is not apparent until the woman reaches her full development as an adult. Then “it becomes apparent that there is a greater power of amassing knowledge on the part of the male.”¹⁹ Furthermore, regardless of if

“... we look to the general average or to the intellectual giants of both sexes, we are similarly met with the general fact that a woman's [fund of] information is less wide, and deep, and thorough, than that of a man. What we regard as a highly-cultured woman is usually one who has read largely but superficially; and even in the few instances that can be quoted of extraordinary female industry—which, on account of their rarity, stand out as exceptions to prove the rule—we find a long distance between them and the much more numerous instances of profound erudition among men. ... there can be no real question that the

female mind stands considerably below the male.”²⁰

Romanes concluded that he was referring to average differences, and thus

“It would be easy to find multitudes of instances where women display better judgment than men But that as a general rule the judgment of women is inferior to that of men has been a matter of universal recognition from the earliest times.”²¹

One compensatory factor is that although

“... woman has been a loser in the intellectual race as regards acquisition, origination, and judgment, she has gained ... certain very conspicuous advantages. First among these we must place refinement of the senses, or higher evolution of sense-organs. Next we must place rapidity of perception, which no doubt in part arises from this higher evolution of the sense-organs—or, rather, both arise from a greater refinement of nervous organization.”²¹

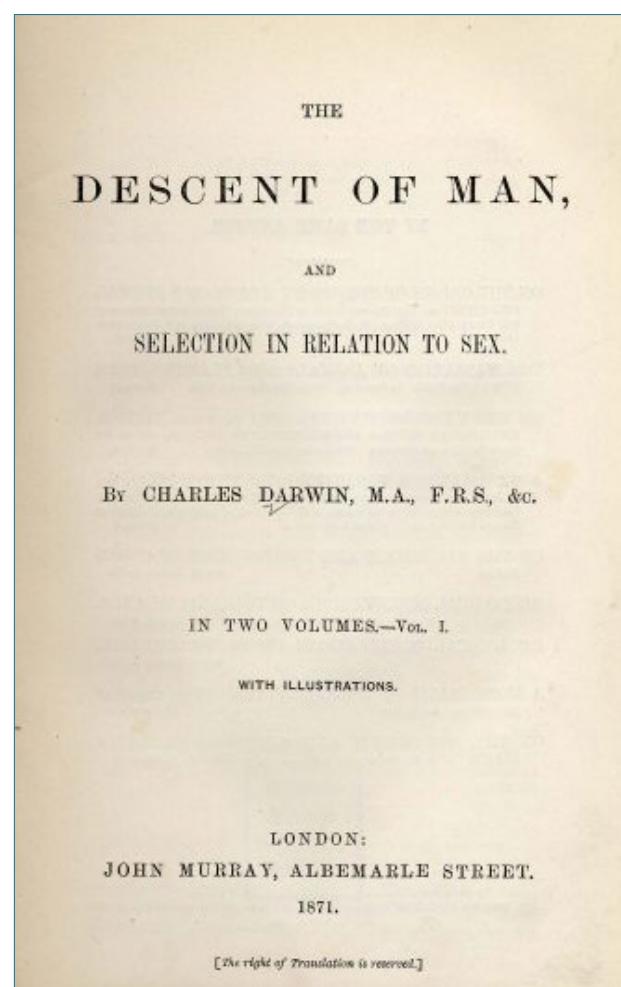


Figure 2. *The Descent of Man* was one of the most influential books in science ever written. This is the title page of the first edition.

Furthermore, Romanes claimed that women, in contrast to men, almost always had less willpower and, as a result, were more apt to break away

“... from the restraint of reason, and to overwhelm the mental chariot in disaster. Whether this tendency displays itself in the overmastering form of hysteria, or in the more ordinary form of comparative childishness, ready annoyance, and a generally unreasonable temper—in whatever form this supremacy of emotion displays itself ...”²²

He also claimed that “We rarely find in women that firm tenacity of purpose and determination to overcome obstacles which is characteristic of what we call a manly mind.”²³

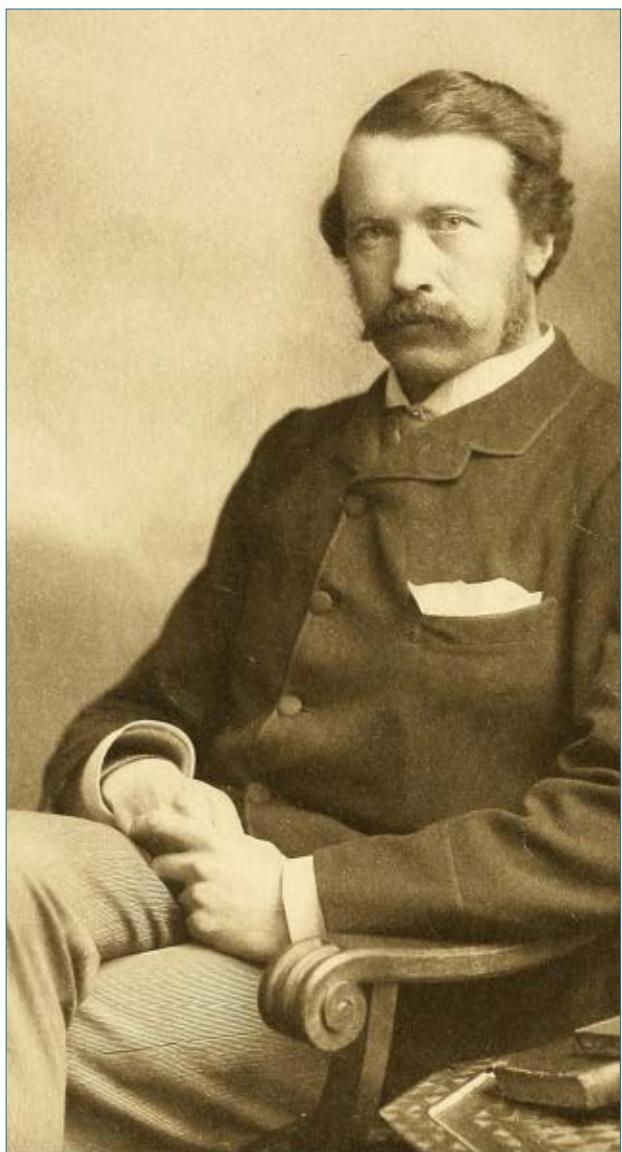


Figure 3. George Romanes was a leading supporter of Darwin and wrote widely about Darwinism in his books and articles.

Romanes quoted Sir J. Crichton Browne who concluded that, not only is the cortex of the female brain shallower than the male, but it also receives less than its proportional supply of blood than the male. For these reasons, women’s mental inferiority could not be explained by the lack of educational advantages enjoyed by males.²⁴ The explanation for these differences, Romanes concludes, is that males are more evolved than females. As Darwin himself wrote, as a result of natural selection, “man has ultimately become superior to woman”,²⁵ claiming that the chief distinction in the intellectual powers of the two sexes is proven

“... by man attaining to a higher eminence, in whatever he takes up, than woman can attain—whether requiring deep thought, reason or imagination, or merely the use of the senses and hands. ... if men are capable of decided eminence over women in many subjects, the average standard of mental power in man must be above that of women.”¹¹

Furthermore, the male

“... being accustomed to rely upon its own strength, is self-central and self-contained: to it the need of external aid, even of a supernatural kind, is not felt to be so urgent as it is to the feminine character, whose only hope is in the stronger arm of another. ‘The position of man is to stand, of woman to lean’ ... although it may be hard for even a manly nature to contemplate the mystery of life ...”²⁶

Another example of the women-are-less-evolved-than-men belief was provided by anthropologist Luke Owen. In an 1872 article in which he attempted to be balanced, he nonetheless wrote:

“Among other and better-known features distinguishing the female sex from the male, are the smallness of the brain-case, the width of the pelvis, and the tendency to deposit adipose tissue, rather than muscular fiber. To the rule, of course, there are exceptions; there are masculine women just as there are effeminate men ...”²⁷

He added, “the desire, if not the capacity, for the prolonged study of abstruse subjects, is less in the female than in the male; and [therefore her] mental activity pursues another course.”²⁷

One last example, of many I could cite, that illustrates this view is anthropologist Gustave Le Bon, who published the following in a respected mainline anthropology journal:

“... there are a large number of women whose brains are closer in size to those of gorillas This inferiority is so obvious that no one can contest it. ... All psychologists who have studied the intelligence of women ... recognize today that they represent the most inferior forms of human evolution and that they

are closer to children and savages than to an adult, civilized man. They excel in fickleness, inconsistency, absence of thought and logic, and incapacity to reason. ... distinguished women ... are as exceptional as [is] the birth of any monstrosity, as, for example, of a gorilla with two heads; consequently we may neglect them entirely.”²⁸

This particular idea was challenged, beginning at the start of the last century and has now been effectively overthrown.

Summary

Darwin and many leading evolutionists and academics accepted the idea that women were less evolved than men, had a smaller brain than men, and thus were less intelligent. This belief demeaned women and strongly impeded women’s educational and social progress for generations. Furthermore, remnants of this myth still exist today. Evolutionists ignored the scriptural teaching of equality that “There is neither Jew nor Greek, there is neither bond nor free, there is neither male nor female: for ye are all one in Christ Jesus.”²⁹ Furthermore, man and woman are created equally in the image of God and together have dominion over the earth:

“Let us make mankind in our image, in our likeness, so that they may rule over the fish in the sea and the birds in the sky, over the livestock and all the wild animals, and over all the creatures that move along the ground. So God created mankind in his own image, in the image of God he created them; male and female he created them.”³⁰

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Clean-up and analysis of small datasets can distort conclusions

Royal Truman

Many important scientific conclusions are based on small datasets with considerable measurement error, especially in areas relevant to the origin of life debate. Including a few very inaccurate or miscategorized data values could produce seriously flawed reconstructions, chronologies or relationships. But removal of data ('cleanup') can also eliminate putative outliers which could invalidate a flawed model. Expertise is often subjective, with warring views producing seemingly compelling proof for their view. Choice of experiments to perform, prior beliefs and reasons for selecting specific mathematical treatments to apply are rarely communicated to the readers of professional papers. Especially problematic is when convictions are used to 'massage' the data, leading to results then argued to demonstrate the validity of the prior belief.

Quantitative scientific data needs to be scrutinized by a subject matter expert (SME) for plausibility before and after mathematical tools are applied and conclusions are published. Erroneous data can lead to flawed mathematical equations of which decision-makers may not be aware. Correcting data requires prior knowledge, and cleaning up datasets can be quite subjective despite the best intentions.

In the past, when I worked in data science, I often encountered outliers that were clearly inconsistent with my empirical mathematical models. In many cases it was possible to trace the error back to the data sources, where explanations included, for example, a decimal point that had been accidentally shifted. But what about the cases where we doubt the validity of some data but have no means to decide if it is wrong?

In the literature, we often encounter examples of data being recalibrated because the researcher believed more strongly in his or her presuppositions than in the data available. In bioinformatics, gene or protein sequences that disagree with phylogenetic relationships can be ignored or removed from the dataset. Is this dishonest, or simply a routine matter of data cleanup? This is an important question especially in those cases where the amount of data available is very limited.

There are many cases of important decisions relying on a small dataset. Examples include hominid fossils, amino-acid-containing meteorites, putative pseudo-genes, tree-ring series to calibrate ^{13}C ages, and so on.

Case study: glycine condensation

I recently examined some data from a paper published by Cronin *et al.*,¹ and, like all data scientists, I have a compulsive need to 'play with' quantitative data. In this *Nature Communications* paper, the team determined the concentration

and size of poly-glycine using dehydration–hydration cycles. Parameters tested included initial concentration of glycine (Gly , 10^{-4} – 10^{-1} M), dehydration times (1–96 h), number of dehydration cycles (1–4), temperature (90–130°C), pH (2.15–10), and concentration of NaCl (0–1 M).

This is useful data because it can help predict the largest Gly_n oligomer formed, using optimal settings. This is relevant for origin of life research, which hopes to account for a natural origin of large peptides. After calculating the theoretically largest Gly_n that could form, one could then extrapolate to more plausible abiotic conditions. Indeed, I concluded that the largest Gly_n would have been much smaller than formed under optimized laboratory conditions.²

While analyzing the data from the Cronin *et al.* paper, I noticed that I was instinctively applying judgment when evaluating the reported data and my mathematical fits. So, is bias always wrong? I decided to share some simple examples from my own *modus operandi* to illustrate several points that are relevant to the origins debate. This led to the *observations* shown in table 3.

I. Using data as is, without data transformation or cleanup

The maximum concentration of Gly_n having $n > 13$ could be estimated by extrapolation using the data in table 1.¹ Higher concentrations resulted after two cycles, but additional cycles led to chemical decomposition, so I decided to examine the data for cycle 2, figure 1.

Plotting the data shows this will be easy to model, figure 1A. In figure 1B I used a logarithmic function. Suppose one believes there are compelling reasons why a logarithmic relationship must be correct, and suspect the reported concentrations for Gly_{12} and Gly_{13} that do not follow this relationship very well might be flawed, figure 1B. Visual inspection shows Gly_{12} and Gly_{13} fall above

the empirical curve, whereas Gly_5 – Gly_{11} all fall below the fitted curve. I re-examined the IP-HPLC traces and concluded that considerable doubt could be raised about the accuracy of the concentrations reported for Gly_{12} and Gly_{13} .

I regenerated the logarithmic curve with the cleaned-up dataset (i.e. lacking these two allegedly wrong data points). The correlation coefficient R^2 jumped from 0.979 (figure 1B) to an impressive $R^2 = 0.991$, based on a new regression equation $14.028 - 5.814\ln(n)$. This could be correctly or mistakenly provided as evidence that glycine oligomers larger than $n = 12$ will not be produced under these conditions, since replacing n with a value ≥ 12 leads to a negative % (*observation 1*).

Suppose instead that we trust all the data and now generate a third order polynomial function, Figure 1C, with $R^2 = 0.995$, which seems compelling and permits extrapolation to higher values of n . However, a negative % yield results for $n \geq 15$, which is physically absurd and indicates the fitted equation should not be extrapolated to high Gly_n values. But, in other studies, it is possible an analyst would have no reason to suspect he or she had overfitted the data set (*observation 2*). As an alternative example, suppose a fourth order polynomial would be offered, also having $R^2 = 0.995$. Now predicted values for $n \geq 14$ are no longer negative, but begin to increase steadily. Since the reported % yield of Gly_{13} was greater than of Gly_{11} , this might seem mathematically plausible. But a chemist would know this is not reasonable. In cases where the analyst lacks a deep understanding of the underlying physical reality, seemingly excellent equations offered could make nonsense predictions.

Performing data transformations

A quarter of the y values of the dataset are less than a tenth the size of the largest value, figure 1A. The regression algorithm minimizes the square of the difference between predicted and reported data, so the largest concentrations will dominate the resulting empirical equation. This is fine if the goal is to predict yields of Gly_n for small values of n , but here the opposite is true; we would like to extrapolate to $n \geq 14$. Therefore, I took the natural log of the y values and plotted them against n , figure 2A. The new linear regression equation has an $R^2 = 0.961$, which is not as high as obtained before (figures 1B and 1C). But now there

Table 1. Oligomer concentrations after number of hydration–dehydration cycles at 130°C after 24 h. Yields calculated as a percentage of the glycine (Gly) starting material.¹

Oligomer	Cycle 1	Cycle 2	Cycle 3	Cycle 4
Gly_2	13.96	10.26	9.42	8.36
Gly_3	10.4	7.7	6.46	5.41
Gly_4	7.61	5.95	5.11	4.41
Gly_5	5.11	4.23	3.53	3.07
Gly_6	3.64	3.71	3.37	3.03
Gly_7	1.91	2.07	1.94	1.67
Gly_8	1.91	2.05	1.07	0.64
Gly_9	1.09	1.3	0.77	0.66
Gly_{10}	0.81	0.93	0.81	0.74
Gly_{11}	0.2	0.32	0.28	0.26
Gly_{12}	0.4	0.56	0.4	0.38
Gly_{13}	0.11	0.34	0.3	0.25

will be better agreement between measured and predicted values in the larger n region. Importantly, this confirmed that, when extrapolating to $n \geq 14$, one no longer obtains negative yields nor increasing yields at high values of n (*observation 3*).

The plot in figure 2A makes clear that data point Gly_{11} is suspect. It makes no sense for the yield of Gly_{11} to be less than for Gly_{12} and about the same as Gly_{13} ; see table 1. Ideally, additional laboratory measurements could be performed to resolve contradictions, but often this now instead requires behind-the-scenes decision making. Data delivered for analysis is often final.

Perhaps the plot in figure 2A should not be perfectly linear but display a slight downward trend. And since we wish to extrapolate to larger values of n , we are reluctant to forfeit our end point at Gly_{13} . If we exclude the Gly_{12} data point, we obtain a minuscule increase in R^2 , figure 2B. Suppose we retain Gly_{12} and exclude Gly_{11} instead, since figure 2A reveals this to be the obvious outlier. This time the improvement in R^2 is rather dramatic (figure 2C), and using the equation leads to very reasonable-looking predictions, figure 2D. (There are statistical principles that can be used to decide which outliers are statistically significant based on assumptions

of the probability distribution of the errors, but this is not our topic here.) The message is simply that researchers routinely exclude data that they believe are flawed, and this is rarely apparent to those reading the reports. Sometimes data exclusions should have been done, but other times not.

The equations in figures 2A, B, and C were used to predict values for Gly_{14} to Gly_{20} , table 2.

Selecting one data point or the other as being an outlier produced a significant relative difference in predicted yield of Gly_{20} (table 2). This effect can be especially significant when large outliers are involved. Major conclusions could be communicated that are flawed because of incorrectly excluded data (*observation 4*). This becomes problematic when the outliers are chosen for removal in a way that strengthens what a researcher believes or wishes to be true. If one wishes to emphasize that large Gly_n won't form, then removing Gly_{12} is a temptation, whereas if one wishes to claim large oligomers are not so difficult to produce naturally, then removing Gly_{11} would be the option of choice.

Selective choice of experiments to perform

Another example of data bias arises in the selection of experiments to be conducted. In the rich amount of data available in ref. (1), we find the data shown in figure 3. Once the cycle time (i.e. duration of the dehydration phase) increases to longer times, chemical decomposition occurs that decreases the % yield of oligomer. This is shown for 110°C and 130°C.

Suppose only experiments at 90°C or less were chosen for analysis, knowing that chemical degradation would be a problem. No malice need be imputed. The researchers could simply be exercising good judgment to use their time and funding wisely. However, based on the now incomplete picture, their readers or sponsors might surmise that continually increasing the dehydration time would steadily increase the yield of oligomers. Based on the green line in figure 3, there would be no reason to suspect otherwise (*observation 5*).³

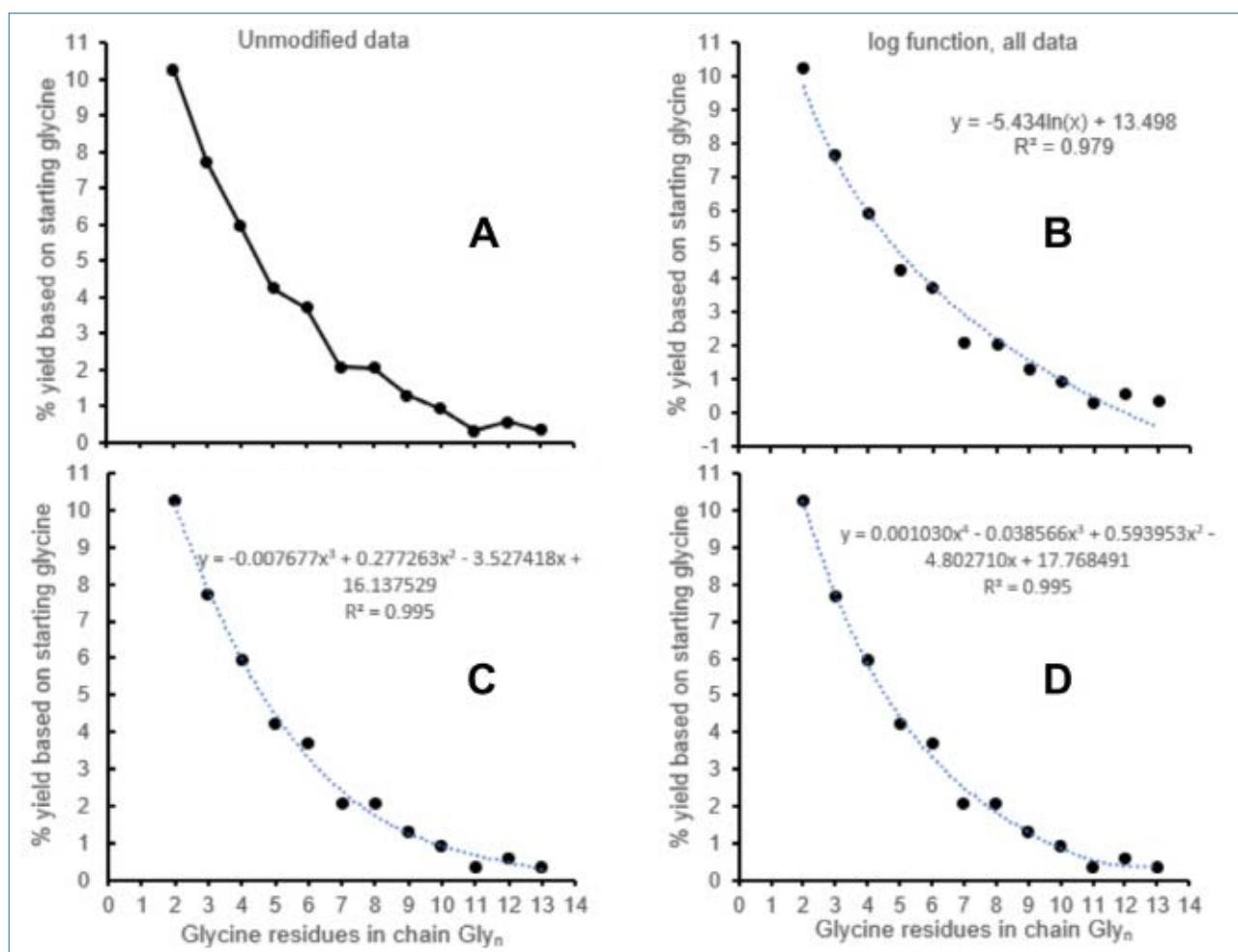


Figure 1. % yield glycine oligomers of size $n = 2-13$. **A.** Plot using all the data. **B.** Fitting of $\ln(\text{yield})$ vs Gly_n . **C.** Modelling % yield using a third order polynomial equation. **D.** Modelling % yield using a fourth order polynomial equation.

The intention of this research was to demonstrate that larger peptides could form in water than believed so far, lending more credibility to a natural origin of proteins. But why would the large peptides formed no longer remain exposed to degrading heat for much longer than 100 h? The cycle durations shown in figure 3 could have been extended to ensure the reader does not overlook what would have occurred naturally. For example, experiments with cycle times out to 500 h at 130°C would demonstrate that larger peptides would be almost entirely degraded.

Homochirality

There are many variants of this kind of bias. Which topic to research is an example. There is a plethora of papers addressing how the origin of biochemical homochirality might be solved naturalistically. Wildly overstated abstracts and summary statements, coupled with irresponsible journalistic sensationalism produces a general feeling that

“someone has found a plausible solution, or with all the promising ideas one will be found” (*observation 6*). They hope that readers will forget that they said the same thing before; now they tacitly admit that the previous claim is no longer believed.

Suppose a comparable amount of effort was being devoted to finding all the experimental and theoretical ways amino acids in free or bound form could racemize. The flood of papers would cement the consensus that amino acid racemization is how nature works. In fact, that is why amino-acid racemization is widely used as a dating method.

Ancient biomaterials

Few researchers deliberately search for biological remains in fossils allegedly millions of years old or measure ^{14}C in diamonds which also allegedly formed millions of years ago. Neither are they focusing resources to examine alternative dating methods which could indicate the earth or life on

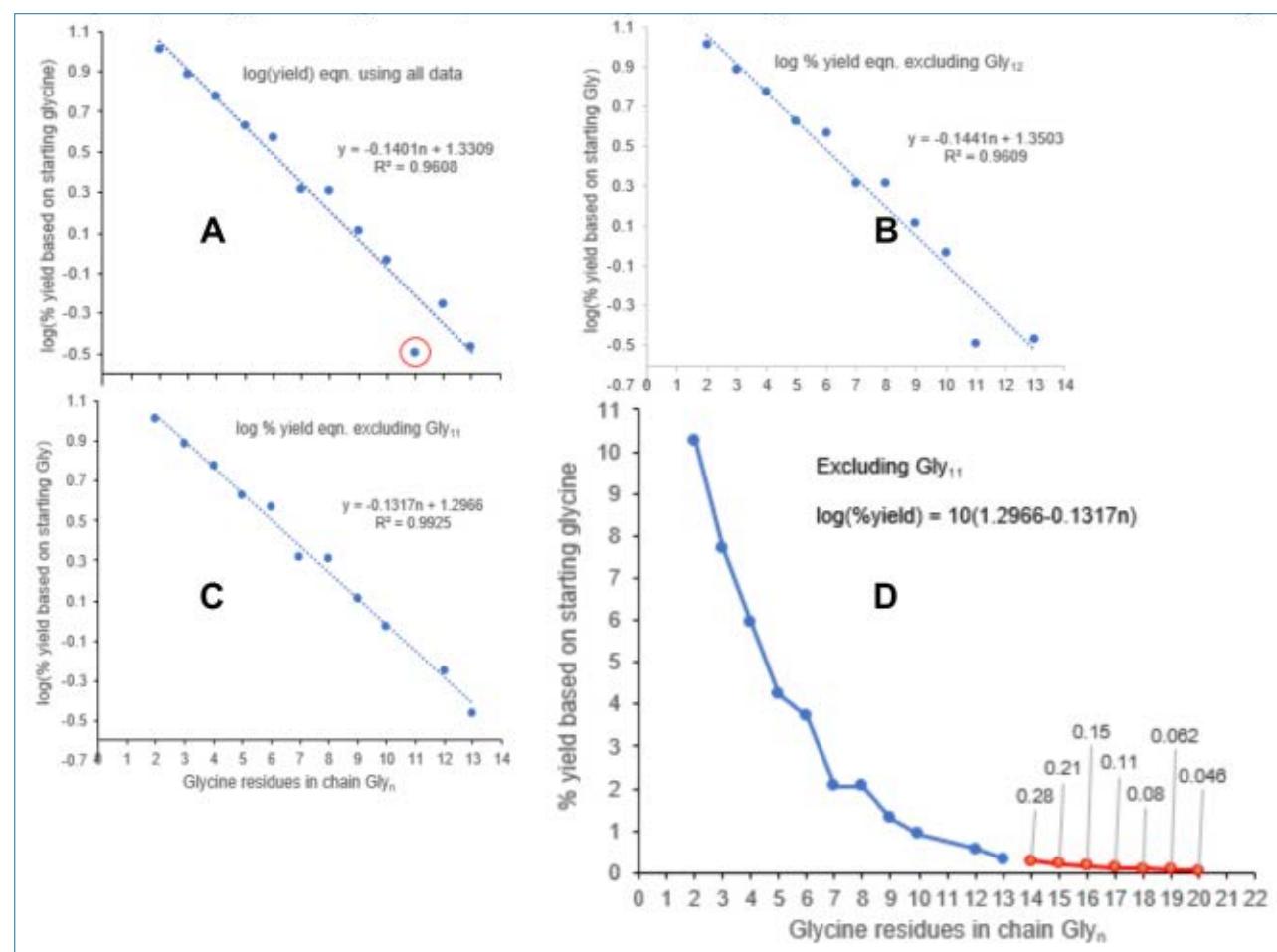


Figure 2. Analysis of the same data used in figure 1 after transforming to the \ln of the % yield glycine oligomers. **A.** New regression equation using all the data. **B.** New regression equation after excluding data point Gly₁₂. **C.** New regression equation after excluding data point Gly₁₁. **D.** Predicted values for $n=14-20$ using the regression equation from 2C.

Table 2. Predicted values for Gly_{14} to Gly_{20} after excluding one or no data points from the dataset. Yields calculated as a percentage of the Glycine (Gly) starting material.

No. of residues, n	Using all the data	Without the Gly_{12} data point	Without the Gly_{11} data point
14	0.23	0.22	0.28
15	0.17	0.15	0.21
16	0.12	0.11	0.15
17	0.089	0.080	0.11
18	0.064	0.057	0.084
19	0.047	0.041	0.062
20	0.034	0.029	0.046

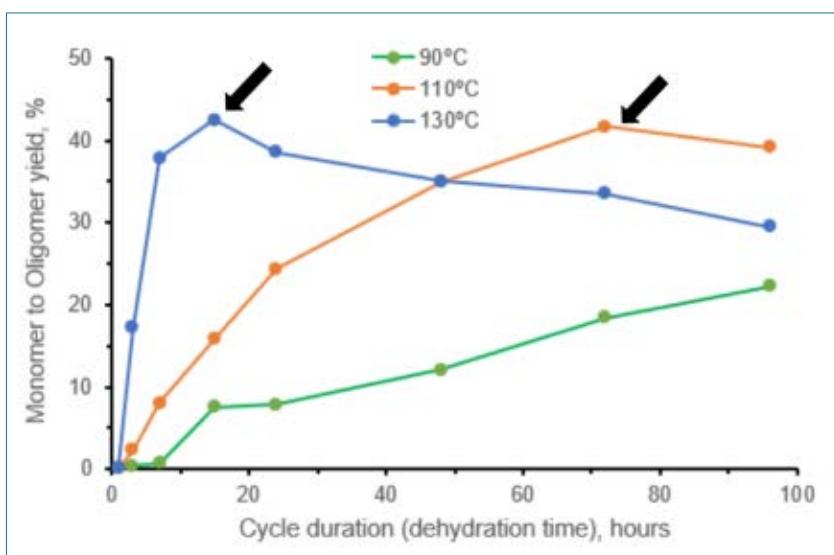


Figure 3. Three temperatures were chosen to experiment with. By avoiding other conditions to test and report, attention is not drawn to results inimical to the researcher's goals.

Earth might be recent. These are obvious research projects young-earth creationists would think of and wish to carry out. Clearly, more Bible-believing students need to become scientists.

Discussion

I cannot think of any paper dealing with origin of life topics having measured laboratory data where I did not wish that specific other tests would also be conducted. Given the dismally growing number of cases where important scientific and medical experiments cannot be validated, it is becoming ever more important to critically question

how conclusions are being reached and communicated.^{4,5} Those working with other premises will often think of alternative ways of interpreting data, or experiments leading to entirely different insights.

There are some subtleties to *observation 5*. In the example in figure 3, the sum of oligomers was reported but the goal of the project was to find the best parameter settings to produce the largest Gly_n . Larger oligomers were produced in mere fractions of a percent, so a sum of all oligomers is not truly addressing the question of interest. It is absurd to imply that pure amino acids would be present at 130°C somewhere for just a few hours before fleeing to the safety of much colder water to avoid degradation. Environments of much lower temperatures where decomposition would be minimized over time are more realistic, so the obvious experiments would be to determine Gly_n distribution at much lower temperatures. This would ensure that the correct facts are available to reach well-reasoned conclusions.

Observation 7 addresses the use of experimental details which camouflage facts that should be more honestly emphasized. An example is the use of glycine for condensation studies to show how large peptides might be formed naturally. ⁶ Glycine is the only proteinogenic amino acid that is not chiral, so is unable to form D- and L-enantiomers, and thus racemize. Poly-glycines cannot produce folded proteins. Another example involves the use of average dates obtained from

different dating methods on the same sample to claim good agreement, whereas the range of values obtained for the same sample could be so great that serious doubt about the alleged agreement should exist. For example, one could exclude a particular measurement or two and the average values suddenly no longer agree at all. I often encounter published tables of data where, for each row, one reads 'average of n measurements', where n is variable. Which measurements were excluded and why is rarely explained.

Unfortunately, there are also examples of unethical bias. Data obtained that contradicts the researcher's thesis might not be reported, distorted, or downplayed (*observation 8*). It might be excluded entirely from the final report or could

Table 3. Insights on how bias affects analysis and reporting of data

No.	Observations
1	Presuppositions guide model building and which data to retain. Contradictory data might be wrong but should be reported.
2	Excellent mathematical fits to a dataset are no guarantee that extrapolations will be accurate. Variables not integrated in the model, or inadequately so, can lead to bad predictions.
3	Analysts often transform the original data for mathematical reasons. The consequences of the pre-processing are rarely communicated to others.
4	Excluding an unexpected result from consideration could prevent a new discovery. Sometimes a strong mathematical relationship results because key points are discarded. Identifying which data is erroneous has a big impact when the dataset is small. It is usually easy to find a reason for excluding a data point. However, none of the data which conform to expectations are challenged.
5	Experiments to perform are based on presuppositions and a desired outcome. For the non-specialist in the subject area this creates the impression that only those outcomes will occur. Parameter values are often selected near the best-case scenario. These optimized experiments establish a pattern in the mind of the reader as to what is expected to occur. ³
6	Researchers select topics to explore. For example, who would write a research proposal for funding by the US National Science Foundation to find ways radioactive dating could lead to a false illusion of deep time?
7	Results can be reported in aggregated manners which ignore the uncertainty in measurements. For example, older values might reflect better what a researcher believes is true than newer measurements. Justifications are easy to find ("it has been contaminated since the former measurements"), so average values could simply be reported.
8	Biases can arise when the research project was funded by an entity with a strong agenda. Reporting 'bad' data along with the 'good' results could make the research team look inept and jeopardize further funding and publication.

be presented as a rare curiosity of allegedly no significance. Being inimical to the researcher's goals, little effort is invested to determine if the outlier is reproducible and, if so, what causes it.

Conclusions

Data clean-up and questioning which data could be flawed are a necessary part of research. Two kinds of errors could arise: data gets included in the models that should not have been or data gets excluded that should not have been. Presuppositions can be so strong that contradictory data is simply dismissed. An example is the view that only naturalist explanations are real, and these can explain all aspects of life. This is an assumption Dr Sivanesan has criticized in depth in his recent book.⁷

Using biased data clean-up to 'prove' a cherished belief can lead to circular reasoning. For example, if our presupposition is that a logarithmic function reflects the true underlying physics (figure 1B), and we remove the two rightmost values (or correct them in some *post-facto* manner), it would be incorrect to then use this new dataset and a new logarithmic fit to 'prove' Gly_n cannot be produced above a certain size. The origin of life literature is replete with this kind of error. Data are recalibrated or dismissed according to deep-time assumptions and this new 'data' is then used to claim that the facts speak for an ancient earth.

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Racemization of amino acids under natural conditions: part 2—kinetic and thermodynamic data

Royal Truman

Racemization of amino acids is frequently claimed to have half-lives on the order of tens of thousands to millions of years. This is misleading. I show that L→D residue interconversion in small, soluble peptides occurs at 25°C on the timescale of only about a century for the first 10% in oceans, rendering them already unsuitable for life-related chemistry. Metal cations, especially Cu²⁺, aldehydes and various minerals in oceans act as racemizing catalysts. L- α , α -dialkyl amino acids from meteorites also catalyze proteinogenic L-amino acid racemization. α -helices and β -sheets can slow down racemization, but these secondary structures would rarely be found under natural random conditions for putative ancestral peptides ca. 35 or fewer residues long. Hydrothermal vents, volcanoes, meteorites, and rapid evaporation cycles would have prevented any build-up of L-enantiomer excess under realistic abiogenesis scenarios. The large amount of racemized amino acids built up during putative millions of years would have quickly contaminated any locally L-enriched amino acids arising through some speculative process.

Peptides require long stretches of L-amino acids to form α -helices and β -sheets. These secondary structures are indispensable to produce folded proteins able to perform necessary cellular processes. Pro-evolutionists are adamant that life must have arisen with no intelligent input and seek a naturalistic origin for homochirality of biochemicals in addition to how the correct amino acid (AA) and nucleotide sequences could have arisen. Tens or hundreds of millions of years of random chemical reactions are claimed to have produced some form of life. Here, in part 2, I will focus on the homochirality barrier and quantify the time available for any collection of optically pure AAs before too much L→D interconversion would have occurred. In part 4 I will provide a remarkable thesis: under realistic naturalistic conditions in water, a homochiral peptide will racemize faster than it would grow in length. I believe this is true for peptides of all lengths at all temperatures. If this is true, enantiopure peptides cannot have arisen naturalistically, even if originally only L-amino acids were present.

Amino acid racemization under acidic and basic conditions

Neuberger proposed, in 1948, that loss of a proton at the C2 carbon of AAs leads to a planar carbanion intermediate. The proton can be regained using either surface of the flat intermediate structure, thereby regenerating the original enantiomer or its mirror image.¹ Therefore, facilitating formation of the carbanion will accelerate racemization. Acid catalysis can help stabilize the carbanion through a C=C double bond

resonance structure. Alternatively, base catalysis can function through direct extraction of the C2 proton (figure 1).

Protonation of amino groups and deprotonation of carboxyl groups on AAs lead to various ionic states, also on sidechains of many AAs such as the carboxyl group of aspartic acid (figure 2). The overall rate constant for interconversion, k_{int} , for the equilibrating reaction L \rightleftharpoons D results from intermediate planar carbanions from each contributing ionic state after removing a proton at the chiral carbon. The individual contributions depend on the concentration of ionic state and its ability to accommodate the carbanion charge.

Racemization rates of free amino acids in water

The rate of disappearance of the L-enantiomer as it equilibrates with the D form is given by [1]

$$\ln\left\{\frac{L_0}{2L_t - L_0}\right\} = 2k \cdot t, \quad [1]$$

where L_0 is the initial concentration of the L-amino acid, L_t the concentration at time = t , and k , which I called k_{int} above, is the rate constant of interconversion L→D and the reverse reaction also, being identical.^{3,4} I provide a derivation for equation [1] in the Appendix. Proteinogenic AAs isoleucine and threonine possess two 2 chiral carbon centres which can also racemize, leading to a more complex kinetic equation.

Equation [1] can be rewritten in terms of the optical rotation of an amino acid solution as

$$\ln(\alpha_0/\alpha_t) = 2k \cdot t, \quad [2]$$

where α_0 and α_t are the light polarization initially and after a time interval, t .³

Literature discussions on abiotic racemization rates often reference the pioneering work of Professor Bada,⁵ who began examining the rate of interconversion L \rightleftharpoons D of aspartic acid during his Ph.D. research, completed in 1968. The rates of racemization of AAs in water were determined over a range of pH values and temperatures over time. Bada showed that, for aspartic acid, k_{int} at a wide range of temperatures was about ten times faster near a pH of 3 or 11.⁴ Between pH 5–8, pH changes had little effect on the k_{int} for the amino acids studied, Asp and Val.

Half-lives of amino acids in pure water

Bada and Schroeder studied the racemization half-lives of several AAs in aqueous solutions at pH 7.6 in the early 1970s by monitoring the change in optical rotation [2] over time. Extrapolating the high-temperature kinetic results to 25°C and 0°C led to the $t_{1/2}$ values shown in table 1.

At the half-life point $t_{1/2}$, equation [1] becomes

$$\ln(2) = 2 \times k_{int} \times t_{1/2}, \quad [3]$$

leading to the necessary relationship:

$$\frac{L_0}{2L_t - L_0} = 2. \quad [4]$$

A little algebraic manipulation reveals that at $t_{1/2}$, $L_t = 3/4L_0$ and thereby $D_t = 1/4L_0$. Therefore, AAs have D/L = 1/3 at their half-life point. This fact can be used experimentally to monitor racemization over time to find the half-life times.

Since $t_{1/2}$ values have been reported, we can calculate the rate constants k_{int} for several amino acids at different temperatures using [3], see table 1. k_{int} values are useful since they permit us to predict all D/L using an equation derived from [1]:

$$\ln\{1 + D/L\} / 1 - D/L = 2 \times k \times t. \quad [5]$$

Of particular interest will be the time, t , to attain various D/L values, which is now easy, knowing the rate constant, k .

The equations above assume that D/L = 0 when an experiment is initiated. If this is not the case, then a correction must be made.⁷ I encounter this in part 5, where, apparently, a non-trivial amount of D aspartic acid seems to be present at the time an organism dies or is generated during the lab procedures.

The racemization half-lives, $t_{1/2}$, for the four AAs reported in table 1 ranged, for the two references, between about two and forty thousand years at 25°C, but long before the $t_{1/2}$ is

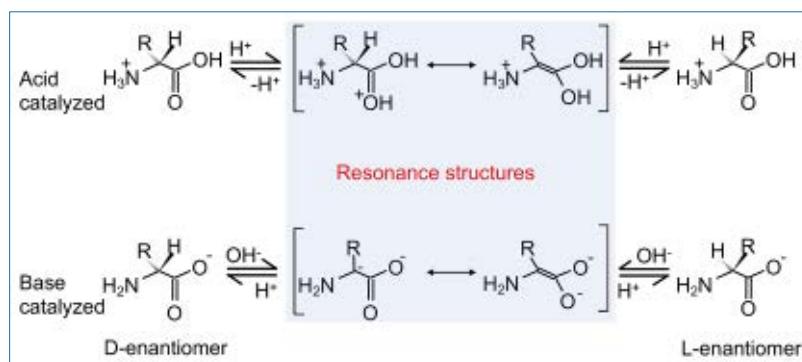


Figure 1. Acid and base-catalyzed L \rightleftharpoons D racemization mechanism of amino acids. Resonance structures provide free-energy stabilizing effects on the planar carbanion intermediate structure. Based on a figure in ref. 2.

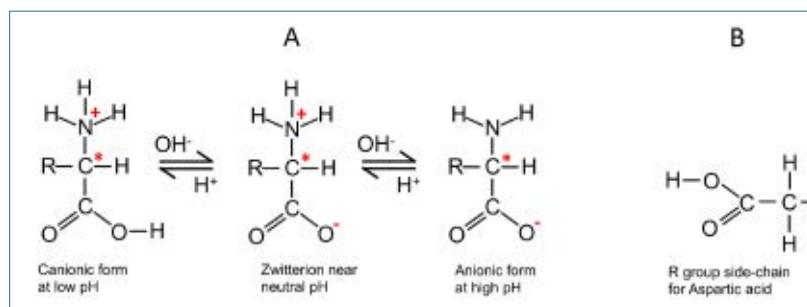


Figure 2. Amino acids can exist in various ionic states depending on the pH. **A.** Amount of protonation of the amino group and deprotonation of the carboxyl group attached at the C2 position depends on the pH. Some amino acid sidechains can also assume different ionic states. Abstraction of a proton at the chiral carbon marked with * leads to a planar carbanion intermediate which permits racemization. **B.** The side group of aspartic acid is shown.

reached too much contaminating D-enantiomer would have formed for origin of life purposes, as mentioned in part 1 of this series.⁸

Bada also reported that the aqueous $t_{1/2}$ of L-amino acids in proteins is considerably shorter than that of free AAs. To illustrate, at 100°C, pH 7–8, protein Asp $t_{1/2}$ was 1–3 days vs 30 days as free AA.⁹ For free isoleucine $t_{1/2} \sim 300$ days was calculated under these conditions.¹⁰ This is an important general principle. Forming peptides (the precursors for big complex proteins) under abiogenesis conditions requires AAs to condense into large peptides, but peptides dissolved in water racemize far more quickly than unbound amino acids. A critic of abiogenesis does not care if an enantiomer excess of an amino acid could be produced somehow which is never able to become part of a peptide.

At higher temperatures all AAs rapidly decompose chemically, limiting the possibility that they could have arisen from sub-surface deposits on the earth.¹⁰ Unsurprisingly, no AAs were found in 319°C hydrothermal oceanic vent waters, consistent with measured $t_{1/2}$ values on the order of ~ 1 min at 240°C; for example, for alanine.¹⁰

Table 1. Half-lives in years for racemization of amino acids in water at pH 7.6 and ionic strength 0.5 beginning with pure L-enantiomer. Since pure water was used, the rate constants for L→D interconversion are considerably lower than found under natural environments where chelating metals are present. Eqn. [1] was used to find the k values.

Amino acid	0°C		25°C			0°C		25°C	
	t _{1/2} , years ^a	k _{int} , /year ^c	t _{1/2} , years ^a	k _{int} , /year ^c		t _{1/2} , years ^b	k _{int} , /year ^c	t _{1/2} , years ^b	k _{int} , /year ^c
Phenylalanine	160,000	2.2 × 10 ⁻⁶	2,030	1.7 × 10 ⁻⁴		160,000	2.2 × 10 ⁻⁶	2,000	1.7 × 10 ⁻⁴
Aspartic acid	420,000	8.3 × 10 ⁻⁷	3,460	1.0 × 10 ⁻⁴		430,000	8.1 × 10 ⁻⁷	3,500	9.9 × 10 ⁻⁵
Alanine	1,100,000	3.2 × 10 ⁻⁷	11,000	3.2 × 10 ⁻⁵		1,400,000	2.5 × 10 ⁻⁷	12,000	2.9 × 10 ⁻⁵
Isoleucine	4,400,000	7.9 × 10 ⁻⁸	34,700	1.0 × 10 ⁻⁵		6,000,000	5.8 × 10 ⁻⁸	48,000	7.2 × 10 ⁻⁶

^a Bada, ref. 6.

^b Bada, ref. 3.

^c Our calculation based on $\ln(2) = 2 \times k \times t$. Using the half-life values, I calculated $k_{int} = \ln(2) / (2t_{1/2})$.

Table 2. Observed and extrapolated racemization rate constants (/year), using underwater sedimentary material. The rate constants at 3°C were extrapolated for the four AAs from the other respective temperatures.¹⁴

Amino Acid ^b	105°C	77°C	58.5°C	49.5°C	25.0°C ^a	3°C
Asx	17.3 ± 1.8	2.10 ± 0.14	0.081 ± 0.025	0.0421 ± 0.0092	0.99 × 10 ⁻³	2.3 × 10 ⁻⁵
Glx	2.98 ± 0.26	0.182 ± 0.033	0.036 ± 0.011	0.0068 ± 0.0095	0.52 × 10 ⁻³	1.7 × 10 ⁻⁵
Ser	6.68 ± 0.38	0.718 ± 0.057	0.069 ± 0.011	0.0275 ± 0.0039	1.3 × 10 ⁻³	4.3 × 10 ⁻⁵
Ala	1.33 ± 0.18	0.0639 ± 0.047	0.016 ± 0.007	0.0142 ± 0.0070	0.55 × 10 ⁻³	4.1 × 10 ⁻⁵

^a I calculated these values using the $\ln(A)$ and E_a values reported in ref. 14 in the Arrhenius equation $\ln(k) = \ln(A) - E_a/RT$ to facilitate comparison with rate constants at 25°C from other studies.

^b Asx = Aspartate or Asparagine; Glx = Glutamate or Glutamine; Ser = Serine; Ala = Alanine.

In the next sections I will review factors which can accelerate amino acid racemization, all relevant for abiogenesis discussion purposes.

Catalytic racemization through metal cations

Stabilizing the intermediate resonance structures shown in figure 2 would render the hydrogen attached to C2 more acidic and accelerate formation of the carbanion. Although hydroxide ion is probably the base which extracts the AA α -proton in aqueous solution at neutral pH, in natural environments any base could catalyze formation of the carbanion, including phosphates and carbonates.⁷

Metal ions like Cu^{2+} , Co^{2+} , and Al^{3+} chelate amino acids, facilitating loss of the α -proton and thereby increasing the rate of racemization by several orders of magnitude.¹¹ The earliest experiments demonstrating this measured the rate of α -proton exchange and mutarotation using proton magnetic resonance and a polarimeter. In these experiments, L-valine and L-alanine carbanions were bound to cobalt complexes, which enhanced the lability of the α -hydrogen.^{11,12}

Bada estimated the concentration of Cu to be $\sim 2 \times 10^{-7}$ M in an ocean. At this concentration, most amino acids would be partially chelated, with Cu^{2+} leading to oxidative

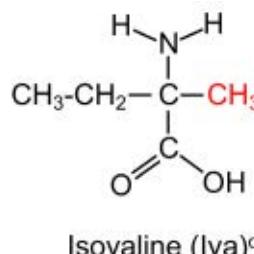
deamination with a $t_{1/2} \approx 350$ years. Therefore, any natural source of fresh L-AA would both rapidly racemize and be destroyed through chemical transformation.³ Based on results reported by Buckingham *et al.*¹¹ and estimating that about 17% of the alanine dissolved in natural waters would be chelated by Cu^{2+} , Bada calculated that at pH 7.6 and 0°C the rate constant for racemization of alanine in natural waters would be $\approx 1 \times 10^{-4}$ /year,³ about a hundred times faster than his results in pure water (table 1). The corresponding $t_{1/2} = \ln(2)/2k$ would be only $\approx 3,500$ years instead of 1.1 million years. Of course, most ocean water has had a temperature $> 0^\circ\text{C}$. Average surface temperatures are currently $\sim 17^\circ\text{C}$, where AAs and peptides are more soluble.

A putative ancient earth would have been flooded with metals such as Cu^{2+} , especially if massive meteorites had pulverized the entire terrestrial surface for tens of millions of years. Therefore, relatively slow racemization rates in pure water such as shown in table 1 are not relevant for abiogenesis discussions. It is important when reading rate constants to take the temperature into account. As we will see below, an increase of just a few degrees can accelerate L→D interconversion by an order of magnitude. The average temperature is not an accurate measure of racemization

Table 3. Decrease in L-enantiomeric excess (ee_L) of alanine (Ala) and 2-aminobutyric acid (Abu) in the presence of α,α -dialkyl amino acid isovaline (Iva) in calcium montmorillonite at 150°C.¹⁷

A			
0.5% Ala loading			
L-Iva:L-Ala			
	ee_L , 0 hrs ^a	ee_L , 200 hrs ^b	ee_L , 1440 hrs
0	86.7%	80%	61.0%
1:1	93% ^b	78%	47.6%
3:1	94% ^b	72%	41.8%
5:1	95% ^b	56%	29.9%
D-Iva:L-Ala			
0	86.7%	79%	61.0%
1:1	94% ^b	79%	51.0%
3:1	94% ^b	75%	45.8%
5:1	94% ^b	61%	34.0%

B			
2% Ala or Abu loading			
α -H-amino acid + Iva	ee_L , 0 hrs ^a	ee_L , 200 hrs ^b	ee_L , 1440 hrs
L-Ala	96.7%	73%	46.2%
L-Ala + D-Iva (1:1 molar)	100%	71%	35.0%
L-Ala + L-Iva (1:1 molar)	100%	65%	29.9%
L-Abu	100%	81%	52.9%
L-Abu + D-Iva (1:1 molar)	100%	81%	43.3%
L-Abu + L-Iva (1:1 molar)	100%	74%	36.8%



Isovaline (Iva)^c

^a Measured at 35°C during sample preparation, before heating to 150°C.

^b ee_L values were estimated from figures provided in ref. 17.

^c Isovaline is a non-biological α,α -dialkyl amino acid which lacks a labile C2-hydrogen and thus does not racemize readily unlike proteinogenic amino acids.

rate, due to the over-proportional effect of small temperature increases.

In 2010 Johnson and Pratt studied the racemization of metal-catalyzed amino acids in iron sulfate brine conditions intended to mimic Martian surface conditions. They reported that racemization was dramatically accelerated, several orders of magnitude faster than previously reported, due only to the effects of minerals AAs would encounter.¹³

Racemization rate of bound and unbound amino acids under natural aqueous conditions

Bada's pioneering work examined AA racemization in pure water, which could not have included various catalytic effects I will further discuss below. Amino acids created by some process would not all remain dissolved in pure water, and charged sediment surfaces could potentially stabilize racemization transitional states. Therefore, Steen and colleagues collected sedimentary material from under ocean water 16 m deep, which contained AAs in a natural setting, both in free form and as part of larger biomolecules. Samples were collected from 0–10 cm, ~30 cm, and ~340 cm below the seafloor. Racemization rates were determined for all three depths. I reasoned that, for abiogenesis purposes, deeply buried layers removed from water would be less relevant for abiogenesis chemistry, and focused on the results from the uppermost layer. ¹⁴C measurements indicated the uppermost layers had been deposited about 25 years before. Being of biological origin, this provided AAs in free form and in peptides in high L-form proportions.

The samples were homogenized using a mortar and pestle, and then wet portions (2 g) were placed into 5-ml sterilized, airtight glass vials.¹⁴ D- versus L-AA ratios were measured over time to obtain the rate of interconversion, k_{int} , at 105°C (over 168 hours), 77°C (602 hours), 58.5°C (165 days) and 49.5°C (165 days).¹⁴ Before measuring D and L concentrations using HPLC, bound amino acid was freed by hydrolyzing in 6 N HCl.

The experimental results were extrapolated to obtain the k_{int} for aspartic acid, glutamic acid, serine, and alanine at 3°C, table 2.¹⁴ These four AAs are the most frequently found in sediments.

Comparing the rate constants for Asx and Ala at 25°C and in the 0–3°C range from table 1 and table 2, I conclude that Bada's use of pure water and free AAs underestimates racemization rates in relevant oceanic environments by about 1 to 2 orders of magnitude.

As a rough rule of thumb, if a sample were to be 100% pure L-amino acid initially, about 0.1% of the residues would become D-enantiomers per year at 25°C until about the $t^{1/2}$ point, at which time enough D would exist for the D→L reverse reaction to become relevant. In other words, in only about a century 10% of the residues would have converted to D. This assumes no contamination by AAs from the rest of the world, although these would have consisted of almost only racemic AAs. In part 1, I conclude that once only 5–10% D is present the L-peptides become worthless for biology-type purposes.⁸ The 1% per thousand years per residue assumes that the internal peptide positions racemize as fast as the N-end only, which may be too fast an estimate.¹⁵

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It has been theorized that peptide-bound amino acids won't racemize as fast as the residues in a terminal position. However, hydrolysis of an internal position would generate two new fragments with terminal residues. Also, fast in-chain racemization of Asn, Asp, and Ser is known to occur.^{15,16}

Catalytic racemization through non-proteinogenic amino acids

Experiments were reported in 2020 by Fox *et al.* at the University of Hohenheim in Germany, designed to model a geothermally heated rock pool that contained amino acids in the clay mineral calcium montmorillonite.¹⁷

Hot volcanic islands are assumed by evolutionists to have existed before continents arose, which would have provided an environment to concentrate organic materials such as L-alanine (L-Ala) and L-2-aminobutyric acid (L-Abu). Fox *et al.* mixed homochiral samples of these AAs with D- and L-Iva (α,α -dialkyl amino acid isovaline (Iva)), which lack a hydrogen at the C2 position and thus racemize only under very harsh conditions, such as γ -irradiation. L-Iva enantiomeric excesses of up to 18.5% have been reported in some carbonaceous meteorites,¹⁸ and many researchers claim that L-Iva could transfer enantiomeric excess to proteinogenic L-AAs.¹⁹ This is based on wishful speculation, not chemical experiments, as I will now show.

Fox *et al.* reported that several percent racemization already occurred with L-Ala samples merely during the process of preparing the amino-acid–mineral suspension, repeatedly dried at 35°C for a short time.¹⁷ This racemization occurred for pure L-Ala, and when mixed with either L-Iva or D-Iva. In fact, fast loss of homochirality for AAs at a temperature as low as 35°C is known to occur during wet–dry cycles,^{20,21} a fact not mentioned in speculative models for concentrating AA through repeated flooding and evaporation cycles on the banks of ancient lakes.

The Fox *et al.* experiments demonstrate that L-AAs and the non-proteinogenic amino acids L-2-aminobutyric acid and a proteinogenic amino acid were converted to D-AAs with increased concentration of both D- and L-Iva, although the effect is greater when L-Iva is used, as shown in table 3. In other words, instead of chirality transfer, L-Iva accelerated racemization of proteinogenic L-AAs! The authors suggested that hydrogen-bonded L-Ala (L-Abu)–Iva dimers would form more readily than the L–D diastereomer for steric reasons, and thus racemize faster. Therefore, the search by evolutionists for the highest concentrations possible for L-Iva in meteorites as a key contributor for the origin of L-AA enantiomeric excess seems misguided, since the ‘wrong’ proteinogenic enantiomers are preferentially formed.

Unfortunately, the researchers did not perform longer experiments with repeated mixing and drying cycles at 35°C of Iva and various proteinogenic L-AAs to draw attention to how loss of homochirality under plausible conditions is often

Table 4. Effect of various aldehydes on racemization of four amino acid^{a,22}

Aldehyde	Reaction Temp (°C)	Racemization (%)			
		L-Ala	L-Met	L-Phe	L-Pro
None	80	7	0	35	0
None	100	13	24	35	3
Formaldehyde	100	83	95	100	63
Acetaldehyde	100	97	100	100	98
Propionaldehyde	100	78	100	100 ^b	87
<i>n</i> -butyraldehyde	80	97	95 ^b	100 ^b	99
<i>n</i> -heptylaldehyde	80	100	100 ^c	100 ^b	100
Benzaldehyde	100	72	100	100	72
Salicylaldehyde	80	100	100	100	91

^a A mixture of L-amino acid (1.5 mmol), aldehyde (0.3 mmol), and acetic acid (6 ml) was heated in a sealed tube in an oil bath at 80 or 100°C for 1 h.

^b A small amount of degradation was observed via thin-layer chromatography (TLC).

^c Considerable decomposition was detected by TLC.

Table 5. Comparison of effect of aliphatic acid solvent on L-amino acid racemization, beginning with pure L-enantiomer^{a,22}

Aldehyde	Racemization (%)			
	L-Ala	L-Lys	L-Met	L-Phe
Formic acid	81	43 ^b	49	100
Without salicylaldehyde	53	19 ^b	18	95
Propionic acid	9 ^c	99 ^b	96 ^b	100 ^b
Without salicylaldehyde	2 ^c	15 ^b	19 ^b	100 ^b
Acetic acid	100	100	100	100
Without salicylaldehyde	13	9	24	35

^a A mixture of L-amino acid (1.5 mmol), aldehyde (0.3 mmol), and aliphatic acid (6 ml) was heated in a sealed tube in an oil bath at 100°C for 1 h.

^b A small amount of degradation was observed via TLC.

^c Because of low solubility, the reaction was carried out under heterogeneous conditions.

on the timescale of days, a disastrous empirical observation abiogenesis advocates should be aware of.

Catalytic racemization through aldehyde catalysis

Loss of enantiomeric excess of D- or L-AAs can be facilitated by various chemicals, including aliphatic and aromatic aldehydes (table 4).²² The assumed mechanism was shown in part 1.⁸

Table 6. Racemization rate constants of Asp residues in an α -helix and β -sheet⁶

A) Values reported in ref. (6)	k $\times 10^2$ per day (°C)					
	90	80	70	60	50	37
(Asp-Leu) ₁₅ ^a	3.37	1.37	0.455	0.145	0.03	0.0059 ^{c,d}
(Leu-Asp-Asp-Leu) ₈ -Asp ^b	4.46	1.985	0.9	0.485	0.175	0.055 ^{c,e}
B) Our calculations for other temperatures using the Arrhenius relationship $\ln(k) = \ln(A) - E_a/RT$. Parameters from ref. (6): (Asp-Leu) ₁₅ $\ln(A) = 34.593$, $E_a = 27.31$; (Leu-Asp-Asp-Leu) ₈ -Asp $\ln(A) = 22.333$, $E_a = 18.38$	k per year (°C)					
	105	77	58.5	49.5	25	3
(Asp-Leu) ₁₅ ^a	65.87	3.61	0.405	0.127	3.9×10^{-3}	0.980×10^{-4}
(Leu-Asp-Asp-Leu) ₈ -Asp ^b	44.67	6.32	1.45	0.666	63.3×10^{-3}	53.5×10^{-4}

^aForms β -sheets^bForms α -helices^cExtrapolated from the rate constants at the other five temperatures using an Arrhenius plot^d $k = 0.0214$ / year^e $k = 0.2020$ / year**Table 7.** Time for Asp residues located in α -helices and β -sheets to reach various D/L proportions at 37°C in years, starting with pure L-enantiomers⁶

Sequence	E_a , kcal/mol	k_{37} /year	D/L	Years ^a
β -sheet: (Asp-Leu) ₁₅	27.3	0.0214	0.10	4.7
	—	—	0.334	16.2
	—	—	0.99	123.7
α -coil: (Leu-Asp-Asp-Leu) ₈ -Asp	18.4	0.2002	0.10	0.5
	—	—	0.334	1.7
	—	—	0.99	13.2

^aYears = $\ln[(1 + D/L) / (1 - D/L)] / 2k$. I assume D/L = 0 at time = 0.

Some of the aldehydes would have been present in comparable concentration as some proteinogenic amino acids in abiogenesis models, such as through influx from extraterrestrial sources. The often-dramatic loss of homochirality documented in table 4 occurred at fairly elevated temperatures and required high concentrations of AA and aldehyde. On the other hand, the experiments were carried out for only one hour; longer evolutionary time would lead to the same trend, accelerated racemization over time.

Rapid racemization also occurred when formic or propionic acid were used instead of acetic acid, as shown in table 5.²²

Unfortunately, experiments were not reported at various lower temperatures or lower concentrations of aliphatic acids which would permit extrapolation to more realistic conditions, to determine what the $t_{1/2}$ of loss of homochirality would be.

Racemization can also be catalyzed under non-acidic conditions. Traditional laboratory racemization procedures using an aldehyde catalyst employ a metal ion which forms a chelate compound with the initially formed Schiff base under neutral or weakly alkaline conditions.²²

Rapid racemization of amino acids located in stable secondary structures

Generally, strict alternation of hydrophilic (hi) and hydrophobic (ho) amino acids induces a β -sheet structure, whereas a tetrapeptide periodicity (-hi-hi-ho-ho-) induces an α -helix conformation when Zn^{2+} cations are present.^{23,24} To obtain a β -sheet, the hydrophobic amino acids must display their hydrophobicity to a marked degree.

Stable secondary polypeptide structures can slow down racemization. Brack *et al.* measured L \rightarrow D rate constants for Asp at different temperatures for an (Asp-Leu)₁₅ peptide which forms a β -sheet and for an (Leu-Asp-Asp-Leu)₈-Asp which forms an α -helix, as shown in table 6.⁶

I calculated rate constants in table 6B for the six temperatures used in table 2 using the available E_a and $\ln(A)$ parameters in the Arrhenius eqn. to

facilitate comparisons. L \rightarrow D is shown to be much faster for Asp, even when present in designed α -helices and β -sheets, than all the AAs reported in table 2.

The average racemization half-life for each Asp at 37°C was around 2 and 16 years when present in (Leu-Asp-Asp-Leu)₈-Asp and (Asp-Leu)₁₅, respectively, indicating that Asp residues racemize much faster in α -helices (table 7), ref. 6. The authors pointed out that without ~ 0.5 equivalent per Asp residue of zinc chloride the secondary structures don't form, and these 30- and 33-residue peptides remain as random coils in water. This implies that for Asp located in randomly produced peptides the E_a must be much lower, and

the rate constant for L \rightarrow D must be faster than when found in α -helices: $k_{int} \gg 10^{-3}$ at 3°C, and $k_{int} \gg 10^{-2}$ at 25°C in water.

Aspartic acid is probably the most easily racemized AA.⁶

Analysis of the rate constants

Asx had a k_{int} in the middle range of the four AAs studied by Steen,¹⁴ so I used it to illustrate how L-enantiopurity is lost over time, as shown in figure 3 and figure 4.

Loss of L-enantiomer will be faster the higher the proportion of L, since little D is available for the back-reaction D \rightarrow L (figure 4). The trend is linear until enough D builds up (figure 4B), so that $k \times$ years in this region predicts [D]/[L] closely. Thus, for Asx a ratio of [D]/[L] = 5% is reached in

$\approx 2,174$ years at 3°C ($0.05 / 2.3 \times 10^{-5}$) for each Asx present in a peptide. A mere 5% contamination of D-residues for an average-size protein of 300 residues represents 15 randomly distributed D-enantiomers, which would generally not be expected to remain functional.²⁵

A high near racemic D \approx L ratio is not necessary for larger polypeptides to be 'ruined'. Even at low temperatures, enough L \rightarrow D interconversions would occur in at most the timeframe of hundreds of years for small peptides, and less for larger peptides, even assuming such large peptides would form in water (a topic discussed on part 3). Since various AAs are involved, those which naturally racemize faster due to their chemical properties will specify the time needed to reach the 5–10% maximum permitted D/L ratio.

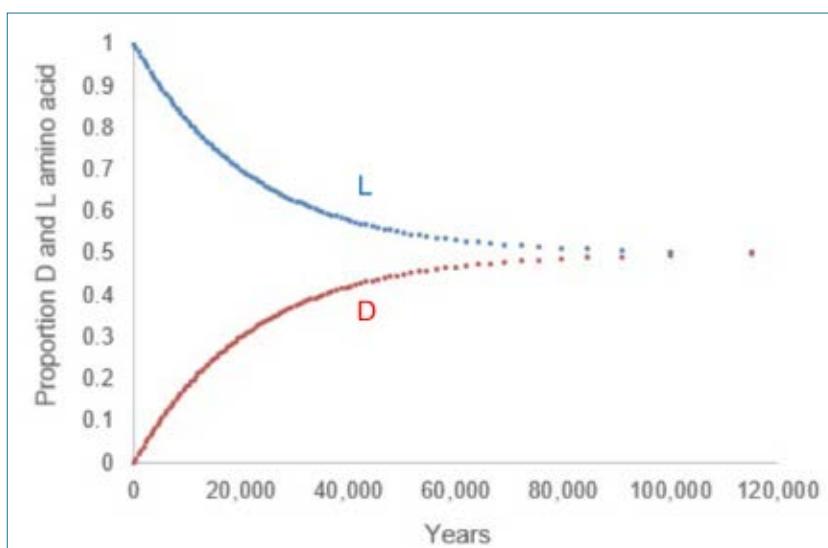


Figure 3. Initially enantiopure amino acids would lose optical purity rapidly and converge to a racemic mixture under natural conditions. Data derived from $\ln((1 + D/L) / (1 - D/L)) = 2 \times k_{int} \times t$, using $k_{int} = 2.3 \times 10^{-5}$ / year for Asx at 3°C in aqueous slurry from ref. 14.

Racemization at relevant temperatures

One must always be cognizant that AAs in solution exposed to elevated temperatures for even very short time periods racemize exceedingly quickly, and prebiotic scenarios are rich in hydrothermal vents, meteorites, and rapid evaporation cycles. Circulating water cannot be assumed to have always remained at a very low temperature for millions of years.

Frigid temperatures of 0–3°C would indeed slow down racemization, but at such temperatures, and realistic amino acid concentrations, large polypeptides will not form, a topic I cover in part 3. The evolutionist now faces a dilemma, since higher temperatures are needed to condense AAs, but racemization

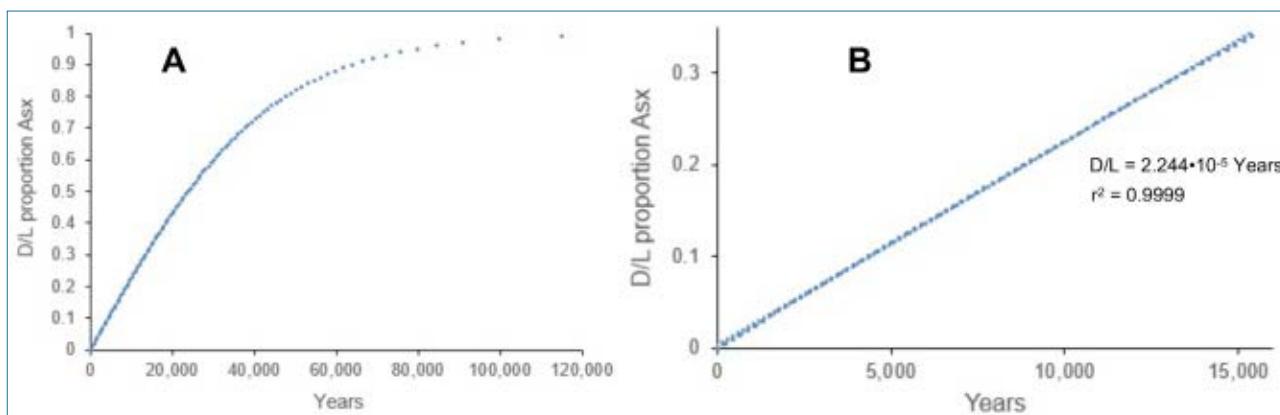


Figure 4. Proportion D/L beginning with no D-enantiomer present in a sample. Data derived from $\ln((1 + D/L) / (1 - D/L)) = 2 \times k_{int} \times t$, using $k_{int} = 2.3 \times 10^{-5}$ / year for Asx at 3°C in aqueous slurry from ref. 14. **A:** Relative rate of production of D-enantiomer slows as the proportion of D increases. **B:** At low concentrations of D-enantiomer, its production increases almost perfectly linearly with time up to about the racemization half-life.

accelerates rapidly with increases in temperature. From table 2, on average, k_{int} is about 3×10^4 times greater at 77°C than at 3°C for the four AAs studied.

Using an average temperature over time can significantly underestimate the amount of D enantiomer produced. Suppose a sample of Asx spent half its time at 49.2°C and half at 3°C, for an average of 26.1°C. From table 2, after $t = 1$ year at 25°C (close enough to 26°C to illustrate), a fraction of ~ 0.001 D would be produced. But using the individual rate constants shows that the amount of D-enantiomer would be more than 20 times greater: $\frac{1}{2}(0.0421) + \frac{1}{2}(2.3 \times 10^{-5}) = 0.021$, and thus about 20 times less time to obtain a fraction of 0.001 D. (For relatively high D/L values equation [5] must be used to demonstrate this effect.)

To help visualize the dominant effect of temperature on loss of enantiopurity, I graphed our calculated D/L values over time using the data provided for 77°C by Steen¹⁴ (figure 5).

In part 1, I showed that just $\sim 5\%$ L \rightarrow D interconversion prevents forming small, stable 3-dimensional peptide structures under realistic naturalistic settings even at low temperatures.⁸ How long would it take to reach a D/L of 5% at 77°C as described above? Using $\ln\{L_0/(2L_t - L_0)\} = 2kt$ or approximating by dividing 0.05 by the rate constants shows that only 9 (Asx) to 286 (Ala) days are needed, with an average of ~ 105 days for all the AAs.

During the millions of years assumed by origin of life researchers, AAs would have been exposed to periods of intense heat, due to volcanism, hydrothermal vents, meteorite crashes, concentration in shallow evaporating pools of

water, and so on. Surface water temperatures near the equator today are around 30°C, and racemized AAs would distribute rapidly during the vast time assumed. Meteorites are a favourite theoretical source of excess L-AAs (but nobody claims D/L values anywhere near 0.1, of course). A meteorite crash would have produced enormous temperatures surrounding any L-AAs delivered from the meteorite.

Conclusions

Vast amounts of time are claimed to offer more opportunities for life to arise, but increasing time decreases any enantiomeric excess which may have formed. Furthermore, during tens of millions of years on lifeless Earth, the total quantity of racemic AA (in free and bound form) would have increased continually with time. This would have made contamination of any L excess which arose much later by some unknown cause ever more inevitable.

I commonly encounter claims that amino acids have half-lives on the order of tens of thousands to millions of years, ignorant of or downplaying the drastic limitation the lack of pure L-amino acids really places on abiogenesis speculations. I believe Bada's old publications, using pure water around the freezing point, lacking the chelating Cu²⁺ found in ocean water, and without considering racemization of residues temporarily bound in peptides (table 1), is at the root of this misperception. My data shows that starting with pure L-AAs, soluble peptides exposed to temperatures of $\sim 100^\circ\text{C}$ would convert enough L \rightarrow D to render them functionally useless on a timescale of merely days. Events such

as bombardment by meteorites, violent volcanism, and plate subductions produce intense heat. Evolutionists recognize that extreme heat would have destroyed a large proportion of existing AAs. However, one finds very few references where they candidly point out that such events would also eliminate any L excess, should it arise somehow. All young-earth Genesis Flood models predict much warmer oceans than we have today up to the end of the Ice Age, so tens of thousands of years were not necessary to produce organic remains with high D/L values.

Many different L-AAs would be needed to form relevant polypeptides, and these will not fold reliably to form proteins if enough D-enantiomers are also present. For abiogenesis purposes, then, the commonly used AAs which racemize the fastest will narrow yet more the 'window of abiogenesis opportunity'. The naturalist models are

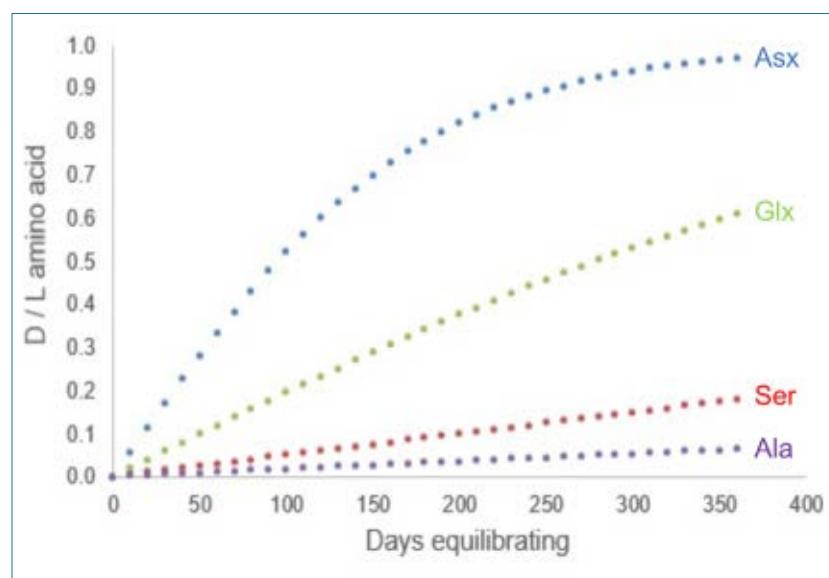


Figure 5. D/L values calculated using $L_t = \frac{1}{2}(1 + e^{-2kt})$ derived from $\ln\{L_0/(2L_t - L_0)\} = 2kt$, where $L_0 = 1$ and $D_t = 1 - L_t$. D/L (i.e. D_t/D_0) values graphed for every tenth day. Rate constants at 77°C from ref. 14. Per day rate constants used: Asx 5.75×10^{-3} ; Glx 4.99×10^{-4} ; Ser 1.97×10^{-3} ; Ala 1.75×10^{-4} . Asx = Aspartate or Asparagine; Glx = Glutamate or Glutamine; Ser = Serine; Ala = Alanine.

forced to posit a steady production of polypeptides based on only L-AAs in high concentrations having relevant sequences, but this is wishful speculation and will not occur under naturalistic conditions.

Appendix

I could not find a derivation for equation [1] in the literature and offer my version here.

At all times during amino acid interconversion,



Since $D = (1 - L)$ and the rate constant k for the forward and backward reactions are identical, the rate of loss of L can be expressed as

$$-\frac{dL}{dt} = kL - k(1 - L) = k(2L - 1) \quad [6]$$

We integrate separately by time and concentration of L

$$-\int_{L_0}^{L_t} \frac{1}{2L - 1} dL = \int_{t_0}^{t_t} k dt \quad [7]$$

Using the well-known solution for the left-hand side,

$$\int \frac{c}{ax+b} dx = \frac{c}{a} \ln|ax + b|$$

$$-\frac{\ln(2L_t - 1) - \ln(2L_0 - 1)}{2} = k(t_t - t_0) \quad [8]$$

Since $\ln(a) - \ln(b) = \ln(a/b)$, and at time = 0, $t_0 = 0$ we can simplify

$$\ln \frac{(2L_0 - 1)}{(2L_t - 1)} = 2 k t \quad [9]$$

Since at time 0, $L_0 = 1$ (i.e. only L-enantiomer is present),

$$\ln \frac{(2L_0 - L_0)}{(2L_t - L_0)} = \ln \frac{(L_0)}{(2L_t - L_0)} = 2 k t \quad [10]$$

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Racemization of amino acids under natural conditions: part 3—condensation to form oligopeptides

Royal Truman

The condensation reaction $\text{peptide}_n + \text{amino acid} \rightarrow \text{peptide}_{n+1}$ in water is thermodynamically unfavourable by about 2.3 kcal/mol per peptide bond at $\sim 30^\circ\text{C}$ and near neutral pH for glycine, due to the stability of zwitterions. An equilibrium ratio of $[\text{peptide}_{n+1}]/[\text{peptide}_n]$ of $\sim 1/50$ results. For [alanyl-glycine]/[alanine + glycine] the proportion is only about 10^{-5} under those conditions. Accelerated peptide growth by reactions such as $2 \text{ peptide}_n \rightarrow \text{peptide}_{2n}$ can only occur in highly concentrated laboratory conditions. Chemically esterifying end carboxyl groups to activate them, sonication, ideal stoichiometries, pH, temperature and pressure are examples of intelligent intervention to force the desired outcome.

Examining reaction parameters systematically (initial concentration of glycine, dehydration times, number of dehydration cycles, temperature, pH, and concentration of NaCl) produced as largest peptide Gly_{12} in aqueous solution and Gly_{14} embedded in an insoluble solid. Mass spectrometry analysis suggested Gly_{20} formed in trace amounts. Products had to be quickly removed after being formed to prevent chemical degradation since amino acids are irreversibly destroyed at $\sim 240^\circ\text{C}$. These experiments demonstrate peptides of relevant size for origin-of-life speculations cannot have arisen naturalistically.

Conditions for peptide condensation reactions

Living organisms depend on proteins to carry out a multitude of functions. These must be composed of L-enantiomer amino acid residues (L-peptide_n) to produce reliable secondary structures such as α -helices, β -sheets, and turns which are necessary for stable folding into tertiary structures. Enantiopure amino acids (AAs) will racemize, whether in free form or chemically bound, as we discussed in part 2 of this series.¹ Much effort has been expended by the pro-evolution research community on a second problem—namely, to find naturalistic conditions to form long peptides. We will review some key reports on this topic, considering their plausibility for origin of life (OoL) purposes.

L-peptide_n must be large and homochiral and both requirements must be satisfied concurrently if an OoL experiment is to have any significance. In part 4 of this series, we will show that optimizing the conditions to obtain larger peptides inevitably racemizes the peptides faster. This fact is hidden by using glycine in the publications, the only proteinogenic AA lacking D and L enantiomers, and thereby incapable of producing folded proteins.

In part 4 we will compare kinetic rate constants and Gibbs free energy changes for racemization and condensation in water. To facilitate this analysis, let us review peptide condensation.

Naturalistic models to drive amino acid condensation

We will not attempt here a detailed review of all the efforts to overcome the unfavourable thermodynamics and kinetics to form polypeptides in aqueous solution under allegedly plausible naturalistic conditions. Without the use of specialized catalysts, very low yields (typically $< 1\%$) of oligomeric products having $n > 3$ residues have been reported when attempting peptide synthesis on clays², minerals³, at air–water interfaces,⁴ on metal oxide surfaces,⁵ and under hydrothermal conditions.^{6,7} Inevitably only glycine was used, intelligently organized to optimize the intended outcome with no relevance to how unguided processes function in nature. We decided not to analyze those studies which are not realistically amenable to any abiogenesis model.

The overall free energy change of hydrolyzation is unfavourable

For n residues linked in a peptide, there are $n - 1$ peptide bonds. The free energy of peptide bond hydrolysis vs formation in aqueous solution strongly favours the dissociated, non-condensed products. This is because at pH around $4.5 < \text{pH} < 7.5$, AAs and peptide fragments form ions which are very stable in water. Therefore, a high free energy is required to generate the neutral form of the reactants necessary to undergo condensation reactions.

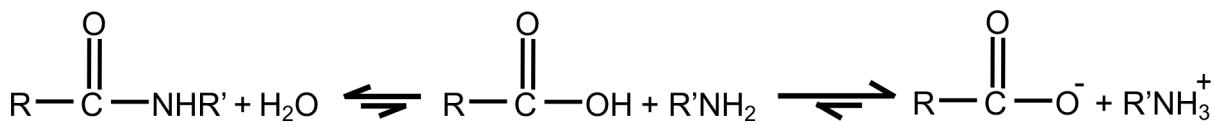


Figure 1. Peptide bond hydrolysis resolved into two contributions: 1) amide bond hydrolysis to neutral carboxylic acid and amino groups, and 2) ionization of these two groups. For amino acids, the charged carboxyl and amino groups are on the same molecules, called 'zwitterions'. (Based on a figure in ref. 8.)

To study equilibrium-rate constants and Gibbs free energy, one can begin from either side of the reaction (figure 1). The reverse of condensation, hydrolysis of a peptide bond to neutral products, is unfavourable energetically, *contra* what most believe; but when it occurs, both fragments generated can then be transformed to the stable aqueous ions.⁸ This is what makes hydrolysis favourable overall (figure 1). This insight is symmetrical. The main reason that the formation of AA condensation products in water is unfavourable thermodynamically is the stability of the initial zwitterions in water.

The overall free energy change of hydrolyzation, ΔG_h , thus includes two effects:

$$\Delta G_h = \Delta G_m + \Delta G_i \quad [1],$$

Table 1. Peptide bond hydrolysis free energy^a and equilibrium constant for glycine (G) in water, 4.5 < pH < 7.5, 25–37°C^b

Reaction	$-\Delta G_i$	$-\Delta G_m$	$-\Delta G_h$	K_h, M^c
GG → G + G	9.9	6.3	3.6 ^b	$373 \approx 400$
GGG → G + GG	7.8	5.3	2.5	$61 \approx 50$
GGG → GG + G	8.8	6.3	2.5	$61 \approx 50$
GGGG → G + GGG	7.6	5.3	2.3	$44 \approx 50$
GGGG → GG + GG	6.7	5.3	1.4	10
GGGG → GGG + G	8.7	6.3	2.4	$52 \approx 50$
polyG → G + polyG ₋₁	7.6	5.3	2.3	$44 \approx 50$
polyG → polyG ₋₁ + G	8.7	6.3	2.4	$52 \approx 50$

^a Free energy changes (ΔG) in kcal/mole at 25°C or 37°C. The change in temperature does not affect the values within their uncertainties of about 0.2 kcal/mole. Reference state is 1 M.

ΔG_h is the overall free energy of amide hydrolysis, including the ionization step.

ΔG_m is the free energy of hydrolysis of the amide bond to uncharged products.

ΔG_i is the free energy of ionization.

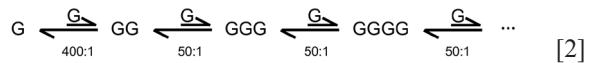
^b Experimental value. All other values in the last two columns were calculated by the author.

^c Using the relationship $-\Delta G_h = 2.3RT \times \log K_h \approx 1.4 \log K_h$ kcal/mole.

where ΔG_m is due to hydrolysis of the amide bond to uncharged products and ΔG_i is the free energy of their ionization.⁸

Martin from the University of Virginia calculated the overall ΔG_h of hydrolysis for glycine (G),⁸ such as via $GG \rightleftharpoons G + G$; $GGGG \rightleftharpoons GG + GG$; and $\text{poly}G_n \rightleftharpoons \text{poly}G_{n-1} + G$ (table 1).⁸ $G + G \rightleftharpoons GG$ was energetically least favourable with an equilibrium constant $K_h \approx 1/_{400}$; for $\text{poly}G_{n-1} + G \rightleftharpoons \text{poly}G_n$, $K_h \approx 1/_{50}$; and $GG + GG \rightleftharpoons GGGG$ $K_h \approx 1/_{10}$. (The values in the last column of table 1 were rounded off, as the authors of ref. 8 also did.)

At equilibrium in aqueous solution, ambient temperatures, and a reference concentration of $[G] = 1$ M, $[\text{poly}G_n] / [\text{poly}G_{n-1}]$ will form at a decreasing proportion of $\sim 1/_{50}$ per residue added



Therefore, the proportion of $\text{poly}G_n$ to G for n residues at equilibrium is approximately

$$[\text{poly}G_n] / [G] = 1/_{400} \times (1/_{50})^{n-2} \quad [3]$$

A small $n = 101$ residue Gly_{101} would only be present in a molar ratio to free glycine of $< 10^{-170}$ at equilibrium at $\sim 25\text{--}37^\circ\text{C}$ ($1/_{400} \times (1/_{50})^{99}$). The general conclusions from table 1 should apply to other AAs. Hydrolysis should be even more favourable due to steric interference for non-Gly residues. Conversely, condensation will be more difficult for AAs containing a bulkier side chain R than H, as found in glycine. Thaxton, Bradley, and Olsen calculated an average free energy of -3.0 kcal/mol per bond.⁹

Having started with only monomeric G, GG must form before GGG can be produced, and so on for larger peptides. Since the hydrolysis reaction $\text{poly}G_n \rightarrow \text{poly}G_{n-1} + G$ is always strongly favoured, and the peptides would be in extremely low concentrations in a plausible abiotic environment, a prohibitively long amount of time would be needed to form condensation product $\text{poly}G_{n+1}$, which, even at equilibrium, would only have a concentration $\sim 1/_{50} [\text{poly}G_n]$. Therefore, we neglected possibilities like reaction [4], which would require two molecules both of extreme low concentration to encounter each other and condense, even

though thermodynamically less prohibitive than $\text{G} + \text{GG} \rightarrow \text{GGG}$.



Bada estimated the concentration of amino acids in a putative abiotic ocean to be $\sim 10^{-10} \text{ M}$,¹⁰ so at equilibrium a dimer would only have been $\sim \frac{1}{400} \times 10^{-10} \text{ M}$. Two dimers would therefore be exceedingly unlikely to encounter each other to form GGGG.

Although true that the free energy necessary to condense two peptides is not as high as for two free amino acids, they would be too dilute for this to have been the primary path to form long peptide chains. For abiogenesis purposes, a large environment such as an open ocean is needed to provide the quantity of AAs necessary for a reasonable number of larger peptides to be generated. However, any small peptide would diffuse and be present in very dilute concentrations, so we conclude that $k[\text{GG}][\text{G}] > k'[\text{GG}][\text{GG}]$, especially for peptides larger than GG.

Brack reported even less attractive numbers for condensations of other AAs. The free energy for the condensation of alanine and glycine to form alanyl-glycine in H_2O was calculated to be + 4.13 kcal/mol at 37°C and pH 7. The equilibrium concentration of the dipeptide for 1 M solutions of the free AA is only slightly above 10^{-5} M .¹¹

Germane to part 4, immense amounts of time would be needed to build up peptides naturally and during the entire time the amino acids would be racemizing.

Oligomerization under high temperature and pressure

Since larger peptides don't form in water naturally, considerable effort has been dedicated to finding suitable conditions to make this possible. Matsuno, at the Nagaoka University of Technology, designed a flow reactor intended to simulate a submarine hydrothermal environment, although he acknowledges some large differences; for instance, in pH, CO_2 , Na, and Cl contents.¹² In one series of experiments, 100 mM solutions of glycine dissolved in pure water were introduced into a high-temperature chamber set at 24.0 MPa pressure, which is slightly above the pressure of the critical point of water, thus keeping it liquefied. The effect of temperature was examined between 110° and 350°C in different runs, with 200°–250°C giving the best condensation results.

After a few seconds in the hot chamber, liquid was forced out into a cold chamber containing water also at 24.0 MPa near 4°C to prevent dissociation reactions such as decarboxylation, deamination, and dehydration. The fluid flowing out of the low-temperature chamber was first depressurized to normal atmospheric pressure, and

5 μl aliquots were examined with HPLC. High pressure was reapplied to force the flow back into the original hot chamber. In this manner solutions producing oligopeptides were repeatedly reintroduced as reactants, using very short cycle times of 34 and 78 s. Outside such a laboratory setup any oligopeptides formed would diffuse into the huge ocean volume instead, remaining in place and permitting further condensation. After about ten minutes the yields no longer increased for the desired products: diketopiperazine (a cyclic peptide formed by dimerizing two glycines) (> 1% yield), the glycine dimer (~ 1%) and glycine trimer (< 1%). No larger peptides were found. The absence of tetraglycine suggests that it was rapidly hydrolyzed into two molecules of diglycine. These were decidedly unspectacular results.

In a second set of experiments, 10 mM CuCl_2 was added to the 100 mM glycine solution at a pH of 2.5 (to facilitate condensation), at 250°C and 24.0 MPa in the hot chamber. The cycle time was maintained at 34 s. Now four different oligomers were found, with the following yields after 30 minutes: diketopiperazine (~ 0.1%), $(\text{Gly})_2$ (< 0.01%), $(\text{Gly})_4$ (~ 0.1%), and $(\text{Gly})_6$ (~ 0.001%).

The copper ions seem to have prevented the hydrolysis of tetraglycine. The authors interpreted the presence of even-numbered oligopeptides up to hexaglycine and the absence of both tri- and pentaglycine to mean that the chain elongation proceeds mainly by aminolysis of diketopiperazine.

The experiments were cleverly terminated after such a short time to prevent degradation of the products. The results confirm the work conducted by Bada in 1995 to evaluate hydrothermal vent type chemistry, who concluded that amino acids are irreversibly destroyed by heating at ~ 240°C.¹³

In later work, reported in 2000, Matsuno *et al.* worked with 40 mL L-alanine, which has no reactive side groups, at 250°C and identified $(\text{Ala})_2$ (< 1%), $(\text{Ala})_3$ (< 0.01%) and $(\text{Ala})_4$ (~ 0.001%). In the same paper, they optimized the conditions and re-examined 100 mM glycine mixed with 10 mM CuCl_2 for a longer experimental time (2 hrs) and managed to produce $(\text{Gly})_8$ in ~ 0.001% yield.¹⁴ The low yield reflects decomposition due to longer exposure to high temperature.¹⁴

These experiments demonstrate that hydrothermal vent-type environments are not plausible environments for OoL models. The carefully optimized experimental conditions included high concentrations of initial AA at a boundary between ~ 250°C and icy water; recirculation of peptides at an optimal rate to concentrate them in a high-pressure, low-volume region against a high temperature and pressure gradient. Even then it was only possible to generate $(\text{Ala})_4$ and $(\text{Gly})_8$ at concentrations of ~ 0.001% after about two hours (after which they rapidly decomposed thermally).

But this work is valuable for our purposes. It illustrates a point we will emphasize in part 4. The environmental parameters modified to accelerate condensation will also

accelerate racemization. In this case, a large amount of Cu^{2+} was indispensable to obtain some larger oligomers, but the cation would also accelerate the rate of AA racemization dramatically.^{1,15} In addition, we want to compare racemization and condensation rates at all temperatures, and Matsuno *et al.* have given us important empirical data for how long it would take to form small peptides at the high temperature of 250°C in water under pressure. We will

use the Arrhenius equation in part 4 to show that $\text{L} \rightarrow \text{D}$ conversion under these conditions would be several orders of magnitude faster than condensation.

Scenarios to minimize hydrolysis of peptides

Special environmental conditions have been proposed to counteract the unfavourable AA condensation thermodynamic and kinetic effects. One environment involves thin hydrophobic air–water interfaces such as those potentially found at the surfaces of lakes and oceans, and in atmospheric aerosols.¹⁶ Griffith and Vaida conducted some experiments using a Langmuir-trough and chemically activated AA leucine having the end carboxyl group converted to ethyl ester.¹⁶ Here we encounter the familiar intelligent intervention by OoL scientists necessary to force the desired outcome. AA-esters condense considerably more readily than normal untransformed AAs. In addition, for the condensation to proceed, coordination to Cu^{2+} (copper (II) chloride) was used, and an external pressure of 15 mN/m was also necessary, using the mechanical barriers of the Langmuir trough. The final solution was sonicated until a transparent solution resulted.¹⁶

The surface pressure of 15 mN/m was chosen to orient the surface molecules, facilitating complexing with Cu^{2+} and hindering condensation products from diffusing into the bulk solution. Mechanistically, the Cu^{2+} probably coordinates to the NH_2 of both AAs. Without compression, the adsorbed molecules did not form complexes with the copper ions or react in any way.¹⁶ The authors did not comment on how this affected the relevance to natural conditions.

The condensation was set up to proceed overnight, but the yield of dipeptide was not reported. Whether further subsequent condensation of an AA to a peptide occurs under these conditions was not reported.

We included this example as a representative study, often cited

Table 2. Oligomer concentrations as a function of number of hydration–dehydration cycles at 130°C after 24 h. Yields calculated as a percentage of the glycine (Gly) starting material.²¹

Oligomer	Cycle 1	Cycle 2	Cycle 3	Cycle 4
(Gly) ₂	13.96	10.26	9.42	8.36
(Gly) ₃	10.4	7.7	6.46	5.41
(Gly) ₄	7.61	5.95	5.11	4.41
(Gly) ₅	5.11	4.23	3.53	3.07
(Gly) ₆	3.64	3.71	3.37	3.03
(Gly) ₇	1.91	2.07	1.94	1.67
(Gly) ₈	1.91	2.05	1.07	0.64
(Gly) ₉	1.09	1.3	0.77	0.66
(Gly) ₁₀	0.81	0.93	0.81	0.74
(Gly) ₁₁	0.2	0.32	0.28	0.26
(Gly) ₁₂	0.4	0.56	0.4	0.38
(Gly) ₁₃	0.11	0.34	0.3	0.25

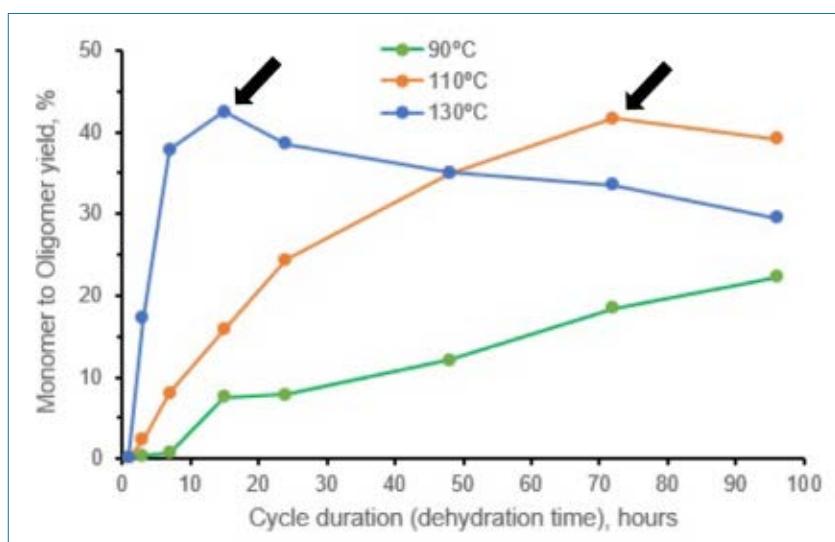


Figure 2. Oligomer yield at different temperatures as a function of experimental cycle duration (i.e. dehydration time).²⁰

as evidence, which used conditions known to facilitate peptide condensation. Although an interesting experiment, its quantitative value is highly questionable. Unless one reads the paper carefully, most would not realize, from the references to this work, that instead it reflects the enormous intellectual effort necessary to obtain even the most modest results with no link to natural conditions.

To be relevant to an abiogenesis scenario, one must assume there could have been a constant supply of esterized AAs delivered to this location. No effort was invested to extrapolate from the ideal conditions, which included esterized AAs, ideal surface pressure applied in the correct direction only, sonication, and suitable stoichiometries. The time to build up a relevant concentration of dipeptides and then larger peptides would have been immense, and during this entire time the residues would have been racemizing. Incidentally, we suspect that coordination of Cu^{2+} would have rendered the two amino groups partially positively charged, facilitating formation of the carbanion intermediate and thereby racemization. More Cu^{2+} would facilitate dipeptide formation, but also racemization.

Largest oligomers produced without catalysts

Given the very low yields of oligomeric products reported in OoL studies, in spite of highly contrived conditions as mentioned above, Cronin and colleagues at the University of Glasgow developed a digitally controlled reactor system they called the ‘abiotic peptide synthesiser’ to run many experiments in parallel to find the best parameters possible.¹⁷ This is valuable work and something we long hoped to do ourselves, demonstrating the best outcome possible under naturalistic conditions, assuming blind chance were to have found these best conditions. Parameters tested included initial concentration of glycine (G, 10^{-4} M – 10^{-1} M), dehydration times (1–96 h), number of dehydration cycles (1–4), temperature (90–130°C), pH (2.15–10), and concentration of NaCl (0–1 M).¹⁷

The optimal conditions involved injecting an aqueous solution of glycine (0.09 M) containing NaCl (0.25 M), pH ~ 10 adjusted with NaOH, into a preheated vial (130°C), which was then maintained at that temperature for 15 h, evaporating the solution to dryness (the ‘dehydration step’).

After only one dehydration–hydration cycle, they observed oligomers in solution with sizes up to Gly_{12} .

The pH had a significant influence. For pH 3.5–7.5 at 130°C, the $\text{G} \rightarrow$ oligomer yield was only ~ 1% of that found at pH ~ 10.¹⁸ Unfortunately, the authors did not report what the largest oligomer would be at an OoL realistic pH near neutral. At neutral pH, glycine monomers are zwitterionic, and interactions between the charged amino group and a charged carboxyl group render them ineffective for dimerization. As pointed out above, zwitterions are thermodynamically very stable in water, hindering the condensation reaction.

Raising the temperature from 90°C to 130°C increased the oligomer yield significantly. At 130°C the highest yield (~ 45% at pH 9.75) was achieved in 15 h. Then the yield decreased steadily with time and a brown colour developed (degradation to other substances¹⁹), as shown in figure 2. At the intermediate temperature of 110°C, the highest yield was reached at ~ 70 h, then decreased also with time. At the lower temperature of 90°C, the monomer → oligomer yield only reached about 20% after 100 h, as shown in figure 2.²⁰

Oligomer proportion was highest for $\text{NaCl} = 0.25$ M, but the decrease in oligomer yield at higher and lower NaCl was not dramatic.

More than 4 cycles would not be expected to create higher amounts of the larger oligomers, Table 2 and Figure 3.²¹ With each repeated cycle, decomposition of especially the larger oligomers increases. Concentrations of oligomers \geq

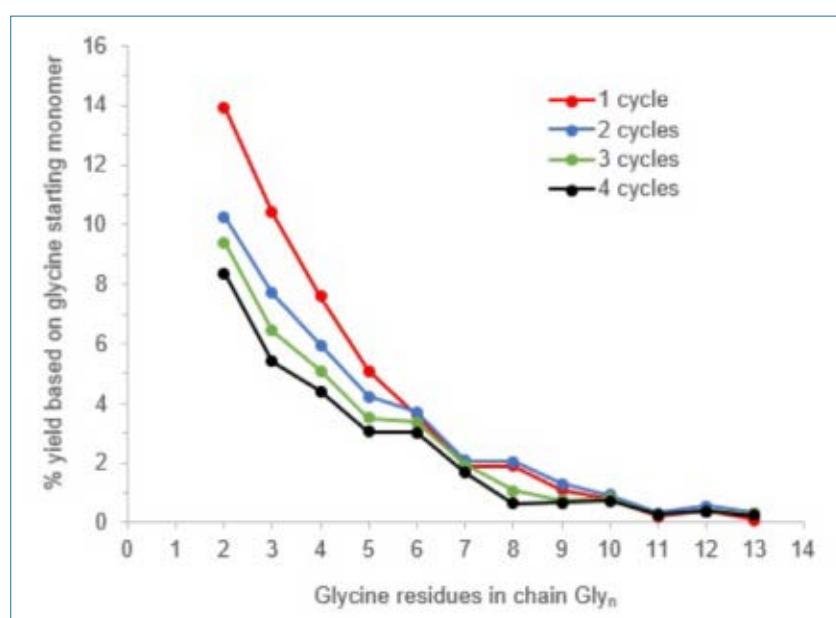


Figure 3. Proportion of glycine oligomers for 1–4 dehydration cycles. Oligomer concentrations are expressed as % of initial glycine. Based on data in table 3 and a figure in the supplementary materials in ref. 17. A pH of 2.61 was used, 130°C, and dehydration time of 24 h.

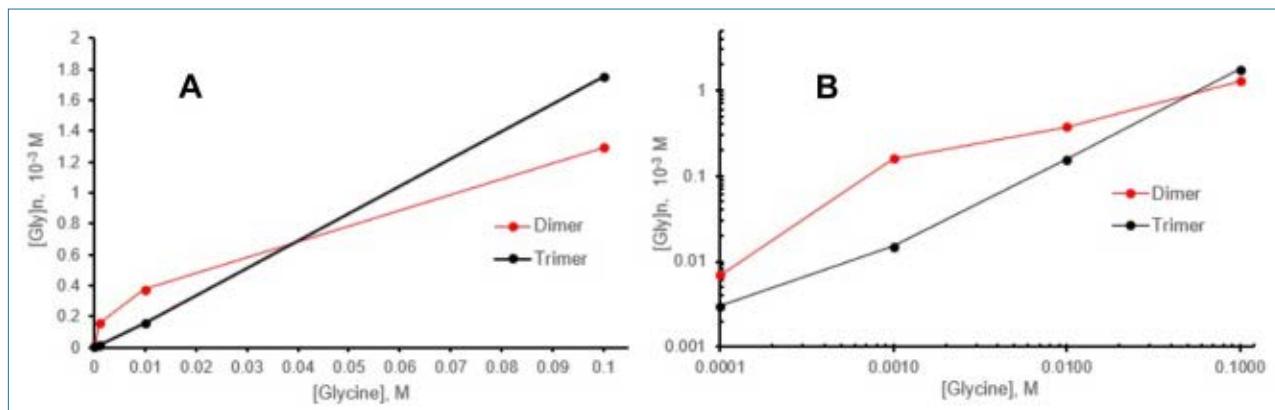


Figure 4. Concentration dependence of Gly_2 and Gly_3 at 130°C.²² A. Plot of Gly vs Gly_2 and Gly_3 . B. Same data plotted on a log-log scale.

$(Gly)_{14}$ could not be detected by IP-HPLC (ion pair high-performance liquid chromatography).

Larger oligomers like these (13 residues) are only formed when the initial concentration of glycine is very high (and temperature ~100°C above room temperature). To illustrate, concentrations of glycine ranging from 10^{-4} to 10^{-1} M were prepared at 130°C. The concentration of the $(Gly)_3$ trimer decreased by almost 3 orders of magnitude when the initial concentration of glycine was decreased from 10^{-1} M to 10^{-4} M, as shown in figure 4B.²²

A mass spectrometric (MALDI-TOF) analysis revealed a peak at 1181.4, which might be the sodium adduct of $(Gly)_{20}$, the largest oligomer claimed, but at an unmeasurably low concentration.

No attempts were reported to find the largest oligopeptides when different AAs were mixed with glycine. Many AA side chains can react, and indeed both branched structures and linear peptides were found for the four-residue products analyzed.

Interpreting the optimized condensation reactions correctly

All chemists are trained in the same basic principles, and most of us researching in universities and industrial labs have no idea which of our colleagues believe in evolution or creation, since this does not affect our work practices. Most creation-oriented chemists perform the same kinds of systematic experiments Cronin *et al.* did.¹⁷ We often face the challenge of finding optimal manufacturing conditions to produce the highest yield of a target material. Automated equipment to explore parameter space is best practice at big chemical firms. Cronin has done what we always hoped to do someday: find the largest peptides and their concentrations under the best naturalistic conditions possible. We would have favoured a DoE (Design of Experiment) approach, since

it is possible that some combination of intermediate values for number of cycles, cycle duration, pH, temperature, and initial concentration of glycine might produce unexpectedly better results. We would have automated the various tests also.²³ Perhaps we could collaborate with the University of Glasgow in an updated project.²⁴

But if this had been our project, we would have written a very different paper or research report. We will show that our conclusions are legitimate, having nothing to do with our position on creation vs evolution. We have done operational science for decades and are concerned that Cronin's wish to support evolution has prevented the desired objectivity in communicating his results. The authors are justifiably proud of their results and emphasize that at the best pH, temperature, and dehydration duration, a 0.09 M aqueous solution of glycine monomers produced larger oligomers than others have reported (≤ 7), and in only one cycle. That certainly reflects good laboratory work on their part, and we congratulate them.

But the authors fail to state the obvious. They have intelligently explored all parameters and identified the settings producing the largest Gly_n , knowing this would not occur naturally. Gly_{20} may have been obtained, but in too low a concentration to measure. An average-size protein has about 300 residues. Furthermore, they only mention in the supplementary materials that the larger peptides are only sparingly soluble, and the HPLC traces revealed no presence of oligomers of size $n \geq 12$. The solid precipitates which formed had to be dissolved by adding trifluoroacetic acid. As a tarry amorphous material, such peptides would continue to racemize (even fossilized peptides racemize); therefore, they would serve no purpose for abiogenesis speculations.

Since the project was designed for OoL purposes, they should now clearly state that without researcher interference the natural outcomes could only have been far more modest. The question is how much more. That analysis is missing, and this is exactly why we have wanted to perform similar

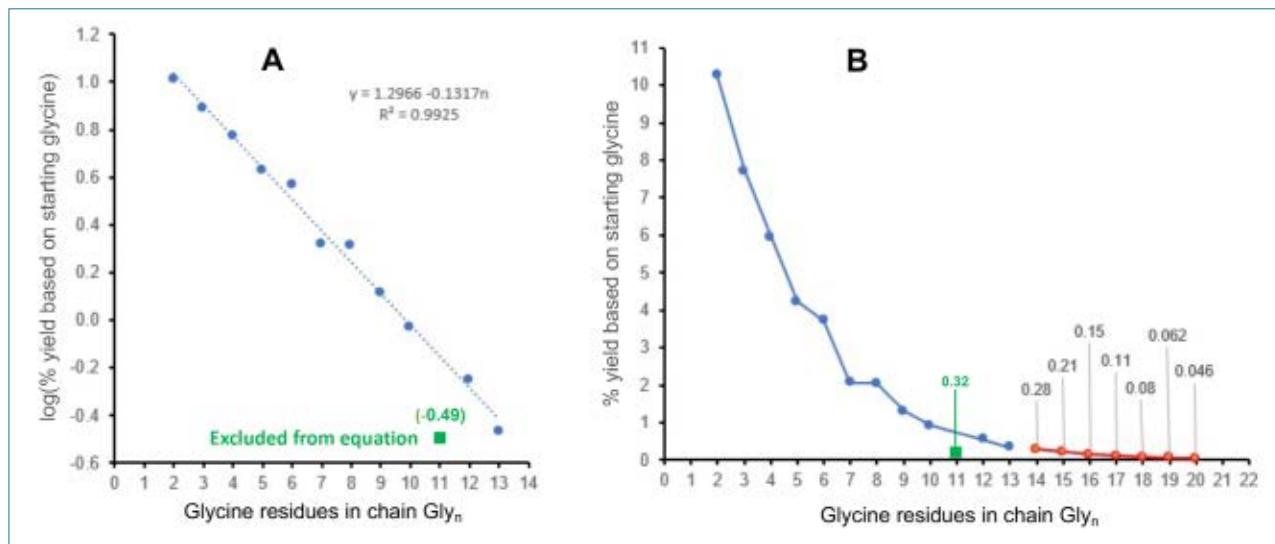


Figure 5. Percent oligomer yields based on starting concentration of glycine, measured at 130°C after two 24-h hydration–dehydration cycles. **A.** Log (% yield) using data from ref. 21 in blue. An outlier was excluded, shown in green. **B.** Predicted values in red based on the empirical equation shown in A, % yield = $10^{1.2966 - 0.1317n}$, where n is the number of residues in peptides Gly_n. The excluded outlier is shown in green.

experiments for years; to extrapolate from theoretical best case towards realistic conditions.

From figure 3 we see that the concentration of peptides decreases rapidly with size. Bada, a leading evolutionist specialist in abiogenesis and amino acids, estimated a concentration of $\sim 10^{-10}$ M would have been available in putative ancient oceans, and not ~ 0.1 M.¹⁰ Cronin *et al.* showed that decreasing the concentration of initial glycine by a factor of 10³ lowered the concentration of Gly₂ and Gly₃ by a factor of 185 and 583, respectively (figure 4). Not only would this decrease drastically the concentration of the larger peptides over-proportionally, but the diluted dimers and trimers would now rarely come into contact, which was a major reason that larger peptides formed in these experiments. Instead of two now extremely dilute peptides condensing, the polymerization rate becomes almost entirely limited to a peptide having to encounter an amino acid, leading to a peptide only one residue larger. We see once again that deep time is evolutionists' great enemy, as the now much longer times involved provide opportunities for decomposition by exposure to heat and photolysis.

Isolation of water in a hot environment followed by evaporation would increase the density of AAs from an initial $\sim 10^{-10}$ M, but also the concentration of many interfering substances, including those mentioned on part 2 which accelerate racemization. The amino acids could not have been delivered from the sources of heat (volcanos, fierce greenhouse effect, meteorite crashes, or hydrothermal vents), since they would have decomposed. Normal lake shore evaporation would be nowhere near 130°C, and condensation between solidified salts won't occur. A theoretical OoL

scenario is not clear. Perhaps the AAs could be delivered by colder water, in which case, after some evaporation, the AAs and peptides would be sure to be diluted again later. But the alternative would be to have them trapped in a hot environment where chemical decomposition becomes inevitable in a matter of hours.

Let us continue modifying the parameters slightly in the direction of more realistic conditions. We will allow for a very heavy dose of optimism in all the parameters, but not to the point of requiring a miracle. The ideal highly basic pH contributed a factor of 10 to 100 improvement. Fifteen hours gave the right results at 130°C. Fifteen hours, not days, millennia, or million years, during which the larger peptides would have completely decomposed. Nature does not work in the manner an astute chemist does. How likely is it that somewhere at around 130°C a collection of concentrated AAs with no interfering substance remained in the right location just long enough before fleeing to safety? Fifteen seconds or minutes would have produced no measurable quantity of large peptides. Everything had to be precisely fine-tuned to obtain good results.

It is common practice to develop mathematical models to perform these kinds of what-if analysis (which is why we would have carried out a DoE first to have the necessary data to develop robust equations). As an example of modelling, one could use reported data to predict the concentration of Gly₁₄ to Gly₂₀ under specific conditions, as shown in figure 5. (Log transformations, as used in figure 5A, are performed to produce reasonably constant prediction errors over wide ranges of y-values). Since the larger peptides are of major interest the concentrations should be measured multiple

Table 3. Chemical conclusions from the optimal oligomerization experiments

Key take-home messages	
1	At the elevated temperatures which led to the best results, the oligomers decomposed rapidly. Since only a few days would have been necessary for their complete destruction, this would have been inevitable over the course of the putative millions of years. The environment would have been flooded with chemical materials, rather than long, straight-chain peptides.
2	Dehydration cycle time had to be set to a mere number of hours in order to produce larger oligomers.
3	Unrealistically high pH values were necessary to achieve meaningful results. At 130°C, the yield of oligomers at pH 9.8 after 24 hrs was about 10 times higher than that at pH 8.1, the pH of current oceans. Unfortunately, the individual concentrations of $(\text{Gly})_n$ at realistic pH values were not reported.
4	The only proteinogenic amino acid not possessing a chiral carbon, glycine, was used. Biological proteins must be formed from enantiopure L-amino acids to produce the specific structures necessary. Reaction of function groups found in the side chains at these high temperatures would produce a smorgasbord of non-linear peptides.
5	The number of larger peptides decreased steadily along the series 2 cycles \rightarrow 3 cycles \rightarrow 4 cycles as degradation increased. Better results will not be obtained with more cycles. However, there is no reason these could not continue to occur naturally, eventually destroying virtually all large peptides.
6	Removing water was necessary, but big, tarry oligomers mixed with other substances would serve no abiogenic purpose.
7	A maximum proportion of $(\text{Gly})_{13}$ / Gly $\sim 10^{-3}$ was only possible after having optimized the parameters. The real-world natural results would be orders of magnitude lower. Oligomers of a size relevant for OoL purposes, > 100 residues, will not be produced naturally.
8	Larger oligomers are poorly soluble. $(\text{Gly})_{12}$ was the largest peptide detectable in aqueous solution by IP-HPLC, and $(\text{Gly})_{14}$ formed a solid precipitate after adding trifluoroacetic acid to render it soluble.

Table 4. Experiments necessary to provide a realistic perspective in ref. 17

Some suggested experiments to perform	
1	Extend our figure 3, which used only 1 to 4 hydration–dehydration cycles, measuring the % yield of each oligomer. (See supplementary materials, table 3 and figure 14 of ref. 16.) Perform six more cycles, since our Table 2 shows a systematic pattern of decrease in peptide concentration when going from two to four cycles. For example, the concentration of Gly ¹³ in mM decreases as Cycle 2: 0.34; Cycle 3: 0.30; Cycle 4: 0.25, and we expect that after only about 10 cycles very few peptides of size > 10 residues will survive degradation.
2	Extend reference 16, supplementary materials figure 7, which documented the concentration of oligomers using dehydration durations of only 1, 3, 5, 7, 15, and 24 h. Perform three more experiments, also at 130°C, with durations 48, 96, and 192 h, measuring the concentrations of Gly ₁₃ and identifying what the decomposition products formed are and their change in concentrations over time. We expect that after only one cycle of duration 192 h very few peptides of size > 10 residues will survive degradation. Note also in ref. 16, supplementary table 1, and figure 5 in the main text of ref. 16, that the total yield of oligomers reached a maximum at 15 h, then steadily decreased with duration of dehydration time.
3	Conduct experiments under the conditions as 2, above, for durations 24 and 192 h, but at temperatures 30, 50, and 70°C. This will show that extrapolating to reasonable temperatures will produce very few of the larger peptides.
4	Use other proteinogenic amino acids, having an alkyl side chain and more complex functional groups and document the concentration of linear oligomer yields, and what alternative products are formed. Reactions involving side chains will hinder the formation of linear peptides and produce many insoluble materials.
5	Document concentration of oligomers for one cycle over a range of dehydration times, beginning with pure alanine instead of glycine. Use a temperature of 130°C and a pH = 9.75, measuring the concentrations of both L and D-enantiomers using HPLC.

times, since small measurement errors would hinder good extrapolations.

We summarize in table 3 some straightforward insights gained from the data provided.¹⁷ Unfortunately, the reader's attention was not drawn to these.

Cronin's pro-evolution bias also seems to be reflected in the fact that several experiments were not conducted which would have been expected from these kinds of agenda-free optimization projects. Conducting such experiments and commenting on them would have offset the distortions perhaps unintentionally provided through the publication.¹⁷ For example, in the supplementary materials, figure 16, an IP-HPLC trace is shown for oligomerization products formed at 130°C and 24 h. The baseline is flat where Gly₁₂ and larger peptides were to be found. How reliable are the reported concentrations? But importantly, experiments were run only at the improbable temperatures of 90–130°C.

Why wasn't a single example run at ~ 50°C, with all other parameters set at the optimal values and then the corresponding IP-HPLC shown in order see what size peptides could be obtained, to provide the reader with some perspective to realistic natural outcomes? Seeing a flat baseline starting around perhaps > Gly₈, despite all the other unrealistic parameter settings (glycine 10⁸ times higher than plausible, etc.), would present a correct but, for OoL purposes, inimical picture. Table 4 summarizes some of the tests we suggest be performed and evaluated publicly.

We are grateful for Cronin's quantitative work, which confirms that the theoretically largest peptides which could form (~ 20 residues in the case of glycine) would only be in trace concentrations after optimizing every environmental parameter. Peptides formed of size \geq Gly₁₃ would be insoluble. This places severe constraints on the sizes and concentrations of peptides able to form under plausible natural environments and a basis for fruitful discussion on OoL speculations.

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- Rodriguez-Garcia *et al.*, ref. 17, supplementary materials, figure 15 and table 4.
- Instead of varying variables at different settings as done here, where we are employed, we would have first done a mathematical DoE (Design of Experiment) in order to gain the maximum information using fewest experiments. This would have led to other reaction settings than those reported here, to cover interaction effects between variables. This would have provided optimal data to develop mathematical models for extrapolation and interpolation, and to display the effects graphically. Despite the immense amount of valuable data collected, the authors cannot tell us for sure what the best settings would be, nor what values for Gly_n would result within the space of parameters they have explored.
- If this project were of commercial interest, my employer might have financed this project for Cronin, like many other university research projects we fund.

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When and how did the marsupials migrate to Australia?

Michael J. Oard

The origin of Australian marsupials is a difficult problem. Uniformitarians challenge creationists to explain how marsupials migrated from the 'Mountains of Ararat' to Australia, but their models also have trouble explaining the problem. I suggest that marsupials arrived early in the Ice Age, which explains features of the fossil sites. During the Ice Age, a complete land bridge was unlikely, so marsupials either swam short distances or were transported by log mats across parts of the Indian Ocean. The uniformitarian model can only posit small mats, but the more massive post-Flood log mats would be more survivable. Indian Ocean currents today would not carry a log mat from the shores of southwest Asia to Australia, but the currents were likely different early in the Ice Age.

Australian marsupials did not need to leave Australia before the Flood to reach the Ark;¹ they had only to migrate *from* the Ark to Australia after the Flood. Arment is correct that the Flood/post-Flood boundary lies below what is identified as late Oligocene at the fossil sites.² However, if uniformitarian dating is not globally synchronous, which I believe, then the middle Cenozoic dating could correlate with some later Cenozoic dates elsewhere.³

Moreover, dates of Australian marsupials are based almost exclusively on their 'stage of evolution', or *biocorrelation*. The Riversleigh marsupials were initially dated as Pleistocene in the early 1900s, but paleontologists later pushed them back to the late Oligocene, based on 'primitive' features.⁴ Regardless of whether paleontologists can devise some kind of fossil order for the marsupials in Australia, for many years this scheme was isolated to Australia and not connected to Cenozoic strata elsewhere.⁵ For a long time, there was a lack of radiometric dates, and paleomagnetism is of no help since it requires independent dates from another method.⁶ Moreover, fossils are usually just compared *within* Australia; they are rarely correlated with marsupial fossils from other continents, since they are so few.^{7,8} Many marsupial fossils are found in the Cenozoic of South America, but they are different from those found in Australia.⁹ As such, much of the dating schema for the Australian marsupial record is circular. This is not surprising; secular scientists move various events, such as the formation of the Antarctic Ice Sheet, up and down the geologic timescale. The Antarctic Ice Sheet was pushed from the late Pliocene/Pleistocene to the Eocene/Oligocene boundary, reaching its present thickness about 15 Ma. Evidence from Riversleigh and similar sites indicates they are most likely post-Flood.³

One exception is the Murgon site in southeast Queensland.¹⁰ It is dated as early Eocene and separated by a

uniformitarian time gap of 25 Ma from the others. This site is likely from the Flood and simply part of the deposition of marsupials and other mammals on *all* continents.⁸ But, just how did the marsupials arrive in Australia?

Uniformitarian scientists challenge creation scientists on Australian marsupials

Uniformitarians challenge creation scientists with the problem of how Australian marsupials migrated after the Flood. Creation scientists have addressed the problem,¹¹ but there are still many unknowns. In an exchange with Nathaniel Jeanson, Stefan Frello said:

"It is therefore relevant to ask how it comes that all these animals [endemic marsupial families] migrated from the Middle East to Australia, leaving no trace behind them, if the biblical story of the Flood is true. Further, they were only followed by those placental mammals that have the best chance of traveling over the sea (a few families of bats and one family of rodents). What a coincidence! I love to think about the poor marsupial mole digging its way from Turkey (Mt. Ararat) to Australia, trying to keep up with kangaroos, koalas, wombats, and numerous crawling, hopping, and gliding marsupials."¹²

Beneath Frello's sarcastic rhetoric, there is an interesting challenge. However, there are at least five plausible mechanisms: (1) a land bridge, (2) island hopping, (3) transport on log mats, (4) human transport, or (5) God's providential direction. Woodmorappe believes Australian marsupials were transported there by humans.¹³ Though plausible,¹⁴ I do not favour this hypothesis. It seems odd that early voyagers would bring just marsupials, including the moles and carnivores.

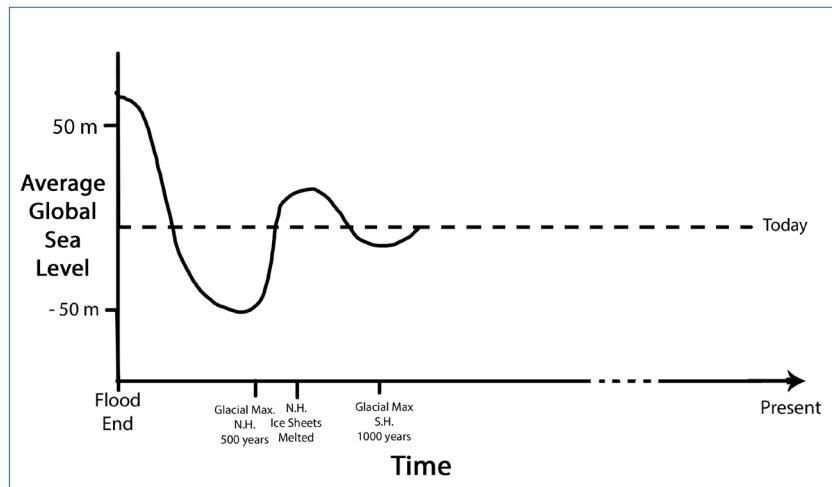


Figure 1. Graph of sea level for biblical history (drawn by Melanie Richard)

Image: Maximilian Dörbecker (Chumwa) / Wikimedia, CC-BY-SA 3.0

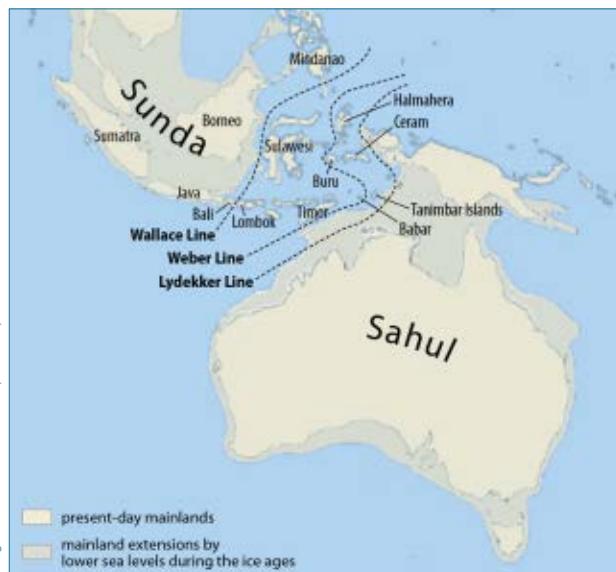


Figure 2. The Sunda and Sahul shelves with a sea level at -100 m . The land on the Sunda Shelf would also be connected at -50 m .

The general problem is the same as for migration across any body of water; and many other types of animals also migrated to Australia. Many creation scientists¹⁵ are interested in how the marsupials arrived in Australia. What makes them especially interesting is that, except for the opossum, marsupials apparently did not migrate to other continents.

Moreover, humans remained in the Tigris/Euphrates area for at least 101 years, giving the migrating animals a century's head start. The Bering Land Bridge would have aided the migration of mammals to the Americas early in the Ice Age.¹⁶ Could another land bridge have existed from southeast Asia to Australia? We will discuss that below.

Evolutionary difficulties in explaining the Australian marsupials

Creationist biogeographic challenges are just as significant as those for uniformitarians. Like Frello, they have many problems explaining marsupial biogeography. In the 1960s and 1970s, uniformitarians hoped that plate tectonics would solve biogeographic puzzles. They initially assumed that plants and animals had evolved on a supercontinent, and as the supercontinent broke up and spread, animals and plants 'rode the plates' to their present locations, then diversified by evolutionary speciation. This would account for numerous endemic species, genera, and even families. This is called the *vicariance hypothesis* because the animals were vicariously or passively transported on the diverging plates.

However, recent studies have shown that many plants and animals did not arrive on separated land masses until *well after* plate motion occurred.^{17,18} Secular geologists believe that Australia broke off from Antarctica in the Eocene—between 45 and 38 Ma ago.⁵ Australia became isolated before the Oligocene—33.7 to 23.5 Ma ago—well *before* the first marsupial arrived. Plate tectonics provides no known land bridges or island-hopping routes. Contrary to the vicariance hypothesis, marsupials had to transverse water—in some cases oceans.¹⁹ It is interesting that Long *et al.* in their cataloguing Riversleigh marsupials do *not* explain how the first marsupials arrived in Australia by 26 Ma.⁵

So, evolutionists face a biogeographic puzzle too. Furthermore, marsupials are found as fossils in the Cretaceous and early Cenozoic on *all* continents.⁸ Why did they not colonize these other continents during all those millions of years? Uniformitarians and creationists alike require dispersal over water, like many other biogeographic puzzles. Similar uniformitarian problems include the intercontinental dispersal of burrowing reptiles²⁰ and the transatlantic rafting of a small, legless reptile.²¹ Their basic problem is, ironically, much like that of creationists.

Marsupials arrive early in the Ice Age

It helps to know when the marsupials arrived in Australia. Within biblical earth history, the evidence suggests they arrived early in the Ice Age.³ They likely found shelter in caves and some became trapped in sinkholes at Riversleigh. The area was unroofed by acid rain afterwards.³ Early in the Ice Age, heavy acid rain from volcanism occurred. In central

Australia, marsupials were buried in lake and river deposits, associated with large pluvial lakes, right through the early Ice Age. Later in the Ice Age, a great drying shrank the pluvial lakes, and the acid rain ended.²²

Was there a land bridge from Southeast Asia to Australia?

A complete land bridge from Southeast Asia to Australia seems unlikely. It would have required significant tectonic uplift early in the Ice Age. At the beginning of the Ice Age, sea level would have been about 67 m (220 ft) above the present, based on the volume of water in the Antarctica and Greenland Ice Sheets. At glacial maximum, sea level would have fallen to about 50 m (165 ft) below modern sea level (figure 1), based on the Laurentide and Scandinavian Ice Sheets, which probably contained less than half the volume proposed by uniformitarians.^{23,24}

At those lowest sea levels, a partial land bridge would have connected the Malay Peninsula, Sumatra, Java, and Borneo (figure 2),²⁵ but its formation may have been too late for marsupial migration to Australia. However, other animals from Southeast Asia probably migrated across this partial land bridge. Evidence for it includes the remains of large rivers on the continental shelf.²⁵ But east of Wallace's Line, several deep, wide ocean channels would have halted migration. The fact that many of today's southeast Asian animals did not migrate to Australia demonstrates the limits of this late Ice Age land bridge.

Wallacea

Wallacea is the area between Wallace's and Lydekker's Lines (figure 3). Alfred Russell Wallace noted that mammals and birds west of the Wallace Line were of southeast Asian origin, while those east of Lydekker's Line were Australian, including New Guinea and the Aru islands on the continental shelf between Australia and New Guinea (figure 3).²⁶ Holt *et al.* confirm that birds conform to Wallace's Line.²⁷ With further knowledge of animal distributions, later researchers modified the boundaries of Wallacea in slightly different locations, such as those either including or excluding the Philippines.

Although Wallace's Line seems anomalous,²⁸ there is a gradual transition between fauna from the west and east in Wallacea (figure 4). Marsupial fossils have been discovered in a cave on the Indonesian island of

Halmahera between New Guinea and Sulawesi.²⁹ Wallace himself later redrew his line east of Sulawesi because of its mostly Asian influence and there being only a few marsupials.³⁰ However, these divisions are not seen within the flora.³¹ This provides a clue about the arrival of marsupials in Australia—mainly that marsupials never passed through Western Indonesia but arrived somehow in Eastern Indonesia and Australia.

Marsupials transported by log mats

If the ocean barred direct migration pathways (a problem for both uniformitarians and creationists), the only option is transport over water. The most reasonable solution is travel on log/vegetation mats. Post-Flood log mats would be a better solution than the very small vegetation mats envisioned by uniformitarians. Such log mats have numerous

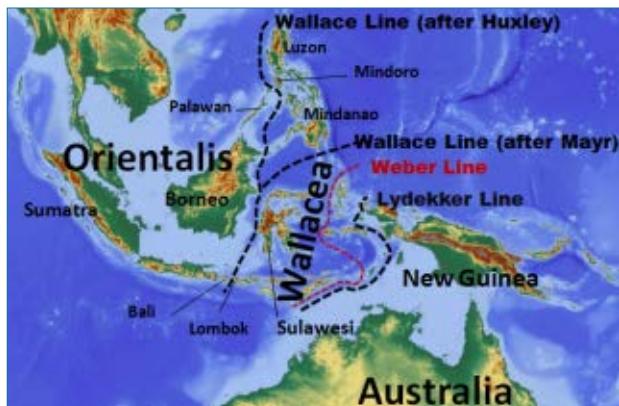


Image: AltaiLeopard /Wikimedia, CC-BY-SA-3.0

Figure 3. A map of Wallacea bordered by the Wallace Line in the west and the Lydekker Line in the east

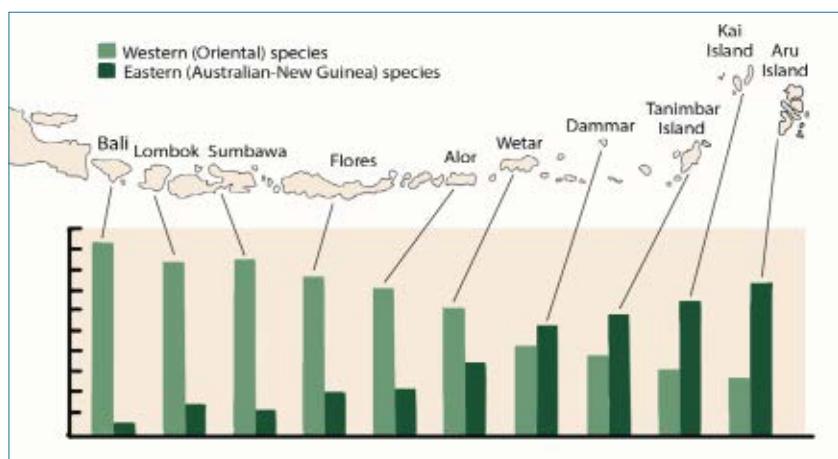


Figure 4. The Lesser Sunda Islands between the Aru Islands on the Sahul Shelf and Java on the Sunda Shelf, showing the change in reptilian faunas from the west and the east (after Lomolino *et al.*, p. 195. Used in accordance with federal copyright (fair use doctrine) law. Usage by CMI does not imply endorsement of copyright holder.).

problems for long-distance transport over water.³² Evidence for log mat transport includes the existence of placental rodents, frogs, lizards, snakes, and soft-bodied arthropods at Riversleigh. The insects include millipedes, ants, beetles, weevils, slaters, and possibly cicadas.³³ Thousands of frog fossils have been discovered there also.³⁴ A wide variety of modern and extinct lizards, as well as snakes, also occur at Riversleigh.³⁵ It would have been difficult for these organisms to have spread from the Ark to Australia, even with a land bridge. It would have been more difficult absent large log mats.

Marsupials must have rapidly migrated to the Indian Ocean

Although post-Flood marsupials and other organisms are not found as fossils in Asia, they probably travelled *rapidly* from Ararat to the Indian Ocean. This seems to be the most workable solution. It would not have been far, since the ocean still flooded the lower Tigris/Euphrates valley, since sea level was 67 m (220 ft) higher than now at the end of the Flood. It is possible they could have made it to Southern Iran or Pakistan or India before boarding log mats. It is noteworthy that pictographs that look like kangaroos have recently been found in India.³⁶ These may represent marsupials surviving after man arrived in India.

The marsupials appear to have migrated together, or those going elsewhere died without leaving a fossil trace. The marsupial mole must have been able to keep up; it likely was not fossorial at the time. Moreover, marsupials that have special diets, for example the koala, probably developed that diet after arriving in Australia. The very large diprotodon—a late Pleistocene marsupial³⁷—may represent gigantism in one variety of an original kind, which possibly included smaller representatives that would have better survived a log mat voyage. In fact, Long *et al.* say that the earliest fossils were small.³⁸ But moderate-sized animals must have been able to survive voyages on log mats, since moderate-sized ground sloths are found in the West Indies.³⁹ It is unlikely such ground sloths swam to the West Indies. The characteristics of the post-Flood log mats may have allowed moderate-sized animals to be transported (see below).

Although Ice Age marsupial fossils are not found in Southeast Asia west of Sulawesi, a rapid migration after the Flood may have left no fossils.⁴¹ After all, God was possibly directing their dispersal. The Bible states that the animals that left the Ark were to be fruitful, multiply, and repopulate the earth. Animals often obey God better than men (e.g. Balaam's donkey). God could have instilled that imperative in those animals to disperse.⁴⁰ Snelling states:

“Therefore, since there is such a small amount of evidence to explain marsupial migrations anyway, and



Image: etliebe / Wikimedia, PD

Figure 5. Logs floating on Spirit Lake, north of Mount St Helens

the ‘question of northern or southern origins has no answer’, who is to say that marsupials could not have migrated into Australia from Asia? . . . Instead, God’s hand would seem to have been involved in guiding and directing these creatures in ways that man, with all his ingenuity, has not yet been able to fathom, in order to ensure that His great commission to the post-Flood animal kingdom might be carried out, and ‘that they may breed abundantly in the earth, and be fruitful, and multiply upon the earth’ (Genesis 8:17).”⁴¹

Post-Flood log mats would have been thick and widespread

Uniformitarians have great difficulty transporting marsupials (and other animals) over water, because their mechanism is by small vegetation mats, like those seen today after storms.^{42,43} Numerous problems occur with the idea of uniformitarian vegetation mat transport.³⁴ Their rejection of the Bible blinds them to the possibilities of massive mats from the Flood.

Post-Flood log/vegetation mats would have been wide and thick. With branches, roots, and probably leaves, these log mats could have become floating islands of compressed and tangled plant material, which likely would have developed their own miniature ecosystems. Such rafts could have contributed significantly to both animals and plants dispersing throughout the world after the Flood. On them, animals could have survived extensive voyages, including to Australia.⁴⁴ Log mats did not vanish at the Flood’s end. Many would have remained floating on the post-Flood oceans until they became waterlogged or broke up.

A rough, small-scale analogy are the numerous floating islands on isolated water bodies adjacent to the Magdalena River of northwest Columbia.^{45,46} The rafts are aquatic plants



Figure 6. A plant growing from the top of a piling along the Columbia River, Portland, Oregon, USA

bound together and floating. As the islands grow, they can harbour large woody vegetation such as vertical trees. The vegetation rafts typically are 30 m long, but some are greater than 100 m. One floating island has trees up to 10 m tall with monkeys in the limbs!⁴⁷

However, a better analogy than modern vegetation is the logs still floating on Spirit Lake dozens of years after the 1980 eruption of Mt St Helens, Washington State, USA (figure 5). Still, post-Flood log mats could have been many metres thick and more stable for moderate-sized animals. The early Ice Age had much more precipitation because of the warm oceans,⁴⁸ so obtaining water likely was not much of a problem. It is likely that some of these log mats were massive enough to include growing plants and trees, and could support moderate-sized mammals, like some floating islands observed in lakes today.⁴⁹ I have observed plants that grow in logs (figure 6). Pumice rafts from volcanism would likely also be left over after the Flood and renewed by post-Flood volcanism. Such pumice rafts may become mixed with the log mats. The pumice and possibly ash that fell on the log mats during and after the Flood could have provided inorganic nutrients, which would have aided plant growth that otherwise could have been hard to come by. Thus, the mammals and other animals on the log/vegetation mat would have been able to eat the growing plants.

Based on observations at Spirit Lake, which showed that all logs but Douglas Fir had sunk to the bottom by 2003 (23 years after the eruption), Wise and Croxton have suggested that the log mats could have been floating on the post-Flood oceans for several *centuries*.⁵⁰ During the first 20 years, it is estimated that about half the Spirit Lake mat sank.⁵¹ The ‘half-life’ of Douglas Firs (the time it would take for half the logs to sink) was estimated to be 75 years. If the sinking of Douglas Fir is an exponential decay function, after 75 years,

half the Douglas Firs would still float, after 150 years, there would be 25% left, after 225 years, there would be 12.5% left, etc. But such a decrease in floating Douglas Fir likely would not proceed as an exponential decay curve for long. Rather, at some point, all of them would have sunk. If this is representative of other types of vegetation, then the log mats could have lasted for a few centuries.

The fact that plants crossed Wallace’s Line could mean that the area was colonized by flora from log mats. As time went on, transport by log mats would have decreased, plausibly helping to explain why marsupials are mainly found in Australia and eastern Indonesia, and not elsewhere.

Animals would have boarded and left the log mats as they temporarily grounded on various coasts. Shorelines with significant tides would have been good candidates for this process. Small herbivores comfortable with the water would most easily have survived voyages, but the primary factor would have been the resilience of the mat itself. In light of the sheer amount of plant debris that would have still been floating on the ocean surface after the Flood and the long ‘half life’ of the Spirit Lake log mats, Wise and Croxton believe dispersal by log mats may have been an efficient mechanism:

“Whereas today’s occasional log or stick provides a ‘sweepstakes’-like probability of successful transoceanic transport, log mats immediately after the Flood may have been nearly as efficient for dispersal of some terrestrial organisms as was the land itself.”⁵²

These survivors would have had greater genetic potential to diversify in different environments than more specialized animals today.⁵³ They could have easily produced ‘endemic’ species, genera, or even families, depending upon the location of the kind within the biological classification system. Evolutionists are again blinded by their theory and cannot appreciate the possibilities of adaptation *within* a kind as an explanation for diversification of the Genesis kinds.

During the lowest sea levels, animals would have been able to migrate between Australia and New Guinea, thanks to the exposed continental shelf. But since some of the islands in Wallacea were separated by deep, wide channels, and still have marsupial fossils, transport by log mats seems likely to have played a large role.

Indian Ocean currents

Surface currents in the Indian Ocean today are inadequate (figure 7) for log mat transport from southwest Asia to Australia. However, currents immediately after the Flood would have been different. Wise and Croxton have India moving northward through the western Indian Ocean and slamming into Asia after the Flood, since they believe that the Flood/post-Flood boundary is at the K/Pg.⁵² Besides

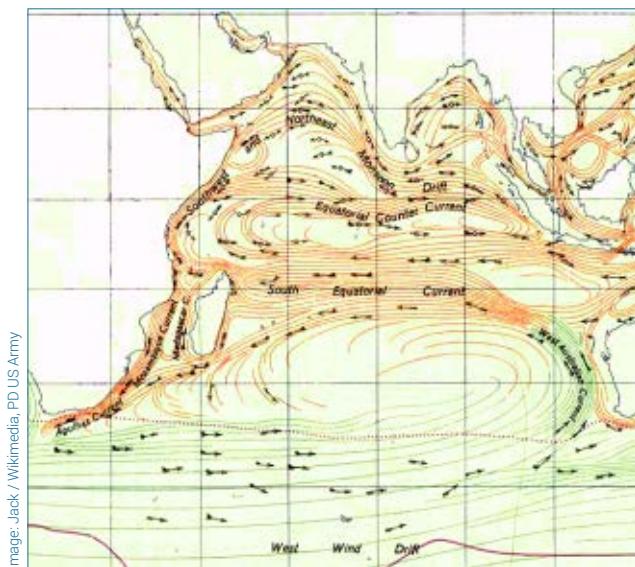


Image: Jack / Wikimedia, PD US Army

Figure 7. Indian ocean currents today

the plate tectonic conundrums that such movement and collision present, the motion is very likely not post-Flood within Catastrophic Plate Tectonics, casting doubt on Wise and Croxton's suggested Flood/post-Flood boundary. The India/Asia collision has a speculative driving mechanism.^{54,55} Besides, it would be difficult for the marsupials to migrate into southern Asia with huge horizontal and vertical tectonics to catch a log mat.

Early in the Ice Age with India in its present location, the west wind drift caused by the Antarctic Circumpolar Current would have been farther south because the warm water of the ocean would have banked up against Antarctica at the beginning. The strongest west winds, generated by strong north-south temperature differences, and storms, responsible for driving the ocean currents, would have been near the Antarctic coast. The South Equatorial and West Australia currents likely did not exist. Thus, Indian Ocean currents would likely have been controlled by the warm post-Flood ocean and the cool continents of Africa and Asia. Could a clockwise gyre have existed in the Indian Ocean, capable of potentially carrying marsupials from the coast of Southern Asia to Australia?

Conclusions

Although uniformitarians challenge creationists to explain marsupial biogeography, they face more severe problems. A complete land bridge reaching Australia was unlikely because of deep, wide channels in Wallacea. Transport by log mats seems to be the likely option for the marsupials and other animals that colonized Australia and Eastern Indonesia. Puny

uniformitarian vegetation mats would have been too small to transport significant populations very far, but large, robust, post-Flood vegetation/log mats could have allowed selected animals to survive longer ocean voyages.

Evidence indicates that marsupials reached Australia early in the Ice Age. Their fossil sites indicate heavy acid rain, suggesting the heavier volcanism of the immediate post-Flood era. The heavier rain would have unroofed caves in karst and maintained the large pluvial lakes in central Australia. Plants would have easily colonized the Sunda Shelf and Wallacea because of numerous log mats grounding in the area, which is why the Wallace Line does not apply to plants.

The marsupials likely migrated rapidly to the Indian Ocean without leaving fossils on their way. Once aboard log mats, they were transported to Australia and Eastern Indonesia during the Ice Age.

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Interface systems and continuous environmental tracking as a design model for symbiotic relationships

Tom Hennigan, Randy Guliuzza, and Grace Lansdell

There is need for a design model of symbiotic relationships in young-age creationism. Symbiotic relationships are crucial for the functioning of healthy biospheric processes and ecosystem stability. Philosophical naturalists posit that these relationships evolved, and co-evolved later as natural selection, initially focused on struggle and competition in simple organisms, led to greater complexity and cooperation through system self-organization. Alternatively, God created complex cooperative systems with astounding complexity from the beginning. He initially created organism archetypes programmed for holistic relational interaction, which is an important element in proposed creation-based species concepts. We also interpret extant species interactions in the light of a planet groaning with dysfunction and death. Therefore, we propose a new design model of symbiotic relationships using human-engineered interface systems as viable analogues for understanding and describing them. A mind is the only known origin of interface systems. If God designed interface systems into creatures, then it is reasonable that their harmonious operation would greatly exceed anything man has devised. A model of interface design has great potential for future understanding of organism interactions, biomimetics, systems ecology, Earth stewardship, and, most importantly, recognizing God's invisible attributes in the physical creation.

A design model of symbiotic relationships is needed within the larger model of young-age creation.¹ It should be both testable and robust in its explanations for these relationships. Symbiotic relationships are complex and ubiquitous in nature, crucial for the functioning of Earth processes, community relationships, and a primary focus of systems biology, ecological research, and Earth stewardship.² ‘Symbiosis’ (Gr: *living together*) was first termed *symbiotism* (German: *Symbiotismus*) by botanist Albert Frank.³ Later, botanist Anton de Berry first coined symbiosis in a speech, as he referred to long-term and intimate alliances between two or more different species.^{4,5} Though definitions and examples have changed and are changing over time, the general consensus is that these long-term associations can have varying effects within intimate relationships. There is much discussion surrounding the details of these relationships and what may or may not be considered a symbiosis, but they are out of the purview of this paper. The purpose of this report is to briefly review the types of alliances and proposed naturalistic mechanisms for the origins of those alliances.^{4,6} We also propose a new model for symbioses using human-engineered continuous environmental tracking and interface systems as viable analogues for understanding and describing biological relationships.⁷⁻⁹

An explanation consistent with Scripture is design-based and organism-focused. It expects autonomous entities with innate design-adapted capacities that were initially created to enable each to work together as parts of larger, non-violent,

cooperative systems. These systems would yield results (some synergistic) that facilitate populations to fill the earth and involve key biogeochemical processes crucial for the health of the planet. This wondrous design would also reflect the good, relational, beautiful, and awesome character of the Creator behind it. Cooperative relationship would not only be at the multicellular level, but extend all the way up to, for example, fungi working together with the seeds of plants that together enable them both to live in colder climates, use less water, and/or produce higher yields.¹⁰ However, it is also important to note that this world groans with pain, dysfunction, and death because of man’s rebellion against God.¹¹ Questions among young-age creationists surrounding what constitutes biblical life and biblical death are debated, and more insight is needed on these topics in order to better characterize the origin of parasitism in a young-age paradigm, where initial relationships were very good.¹² Creationists should lead the way in explaining these highly complex interactions as the work of a Creator and intimate designer who wants to be known, desires to rescue us from ourselves, whose love is reflected in highly complex systems designed for life provision and sustainment, and who is deserving of great glory and honour.¹³

Symbiosis classification categories

Symbiosis classification can be complex and confusing, as there are several subcategories of relationship characteristics.⁶

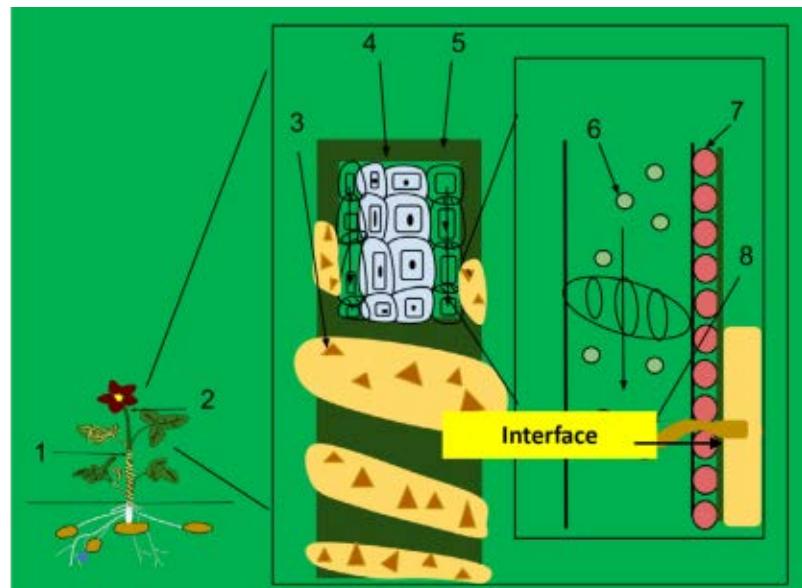


Figure 1. Photo, left. A parasitic relationship between dodder (*Cuscuta* sp.) and host plants. Modified illustration, right. Germinating dodder seeds detect chemicals produced by a host plant (in this case the potato, *Solanum tuberosum*), and grow toward it. Once attached, dodder curls around the potato stem. A root projection, called a haustorium, then penetrates the host and takes sugars and nutrients.¹⁷ As a parasite, the dodder does not generally kill its host.

Parasitism, mutualism, and commensalism are classified as functional relationships and describe how symbionts interact with each other. Parasitic relations describe intimate relations of one species taking nutrients from another that does not generally result in death of the host (see figure 1).^{14,15} Parasites can be contrasted with parasitoids, which are insects with a free-living stage that have intimate relationships with a host, during parts of its lifecycle, but generally kill the host in order to complete its lifecycle.¹⁵ It has been estimated that nearly all organisms on the planet are host to at least one parasite species.¹² As will be discussed below, some species can become parasitic and/or pathological under certain circumstances. Commensal alliances have not been well researched. They have been historically defined as relationships where one member is not affected by the relationship, but the other is benefited (see figure 2).^{16,17} However, some commensal relationships have been reclassified as mutualisms with further research. Some investigators are suggesting that they are more complex than was thought, because interactions are dependent on groups of phenomena depending on ecological processes and relational components.¹⁸ Mutualistic symbioses are alliances where all involved benefit (see figure 3).^{19,20} There are also categories of structural relationships. Francis simplifies the structural categories into two broad groupings: the location of symbionts in relationship to one another and the degree of dependence they have for one another.³ There are three structural subcategories of locations that symbiologists have

identified. *Endocytobiosis* occurs when one symbiont lives inside the cell of another, such as bacteria living inside protists that reside in the gut of termites.²¹ *Exocytobiosis* is where one symbiont is external to the other, as in lichens, and *endosymbiosis* occurs when one symbiont is extracellular but operates in internal spaces, such as protists in the gut lumen of termites.^{3,21} As for the degree symbionts are dependent on one another, they can either be facultative or obligate. The above overview is a superficial view of the ubiquitous types of symbioses found in nature, but how might these alliances have originated?

An overview of a naturalist understanding of the origin of symbioses

Though some authors have claimed that universal descent with modification is not robust enough to fully explain the origin of symbiosis, evolutionists are in general agreement that natural selection and mutation events can consistently address reasonable explanations for their origins, which are assumed to begin with simple organisms that were not symbiotic.²² Some complex mutual symbioses, such as lichens and arbuscular mycorrhizal fungi, have been conventionally dated 600 million and 400 million years respectively.^{23,24}

Historically, symbiotic alliances were not thought to be common, nor were they considered phylogenetically significant. Since Darwin, much of the evolution emphasis

has focused on struggle and competition, but cooperation (e.g. kin selection, group selection, reciprocity, and by-product mutualism) is also crucial in an evolutionary paradigm in order to understand symbiotic associations and the success of mammals.²⁵ A landmark paper by Margulis (Sagan) on endosymbiotic theory was a turning point in a naturalistic understanding of eukaryotic cell evolution.²⁶ Though it took time for the scientific community to acknowledge, and not all of her hypotheses were correct, the evolutionary community is in general agreement that her key explanations for cells merging into one another through cooperation is consistent with an evolutionary understanding for the origin of eukaryotic genomes, chloroplasts, and mitochondria.²⁷ Simple cells continued to evolve in organismal and relational complexity, and symbiotic alliances were considered key evolutionary events. Two general directions of investigation have been the focus of symbiotic origins: 1) how antagonistic and autonomous organisms entered into mutually beneficial alliances, and 2) the capturing of an organism by another organism with a symbiotic history.²⁸

It is important to keep in mind that the degree of association is assumed to be based on the energetic costs and benefits that are inherent for an association to be established.⁶ In systems ecology, it is all about energy and efficiency. Many would argue that initial organisms were produced by random natural processes, but, as more and more organisms interact in a system, natural selection drives that system into increasing specialization, cooperation, efficiency, and complexity, resulting in ecosystem resilience and stability.²⁹ For example, competitive relationships are not considered energy efficient because some of the precious energy required for life (e.g. foraging, mating, thermoregulation) is used to compete for resources. Therefore, natural selection can drive competitors into more energy efficient interactions such as microhabitat separation (e.g. stream insects inhabiting substrate while others live at the surface), temporal separation (e.g. hawks hunting by day and owls by night), resource partitioning (e.g. Galápagos finch beak diversification allowing for a variety of seed resources for a diversity of finches) and mutualisms (lichenized fungi, and/or algae/ cyanobacteria cooperating as one organism).

As evolutionary processes continue through time, symbiotic interactions can hurt or help their partners, depending on the natural circumstances and identified genetic mechanisms. For example, Douglas³⁰ describes a *Photorhabdus* bacterial species in a mutual alliance with a heterorhabditid nematode residing in its gut. The nematode provides food and shelter to the bacterium and the bacterium helps the worm in its healthy growth and development. But the nematode is an endoparasite of soil insects. When the bacteria are released into the insect by the nematode, the bacteria are pathogenic to the insect. The bacteria multiply and thrive on insect nutrients and produce toxins that inhibit other parasites. The nematode will also feed on the bacteria

as the insect weakens. As conditions worsen, the worm produces a non-feeding nematode form, gets colonized by remaining bacteria, and returns to the soil to find another insect. The genetic mechanisms for this complex behaviour are carefully orchestrated and some have been identified. *HexA*, for example, positively regulates for mutualism and negatively regulates for pathogenesis.³¹ Other genes have been identified up and down regulating for pathogenesis and mutualism as well. There are many relationships like the above, and researchers suggest that these relationships began as antagonistic pathogens and that genetic circuitry evolved to have a balanced control of mutualism and pathogenesis because benefits outweighed costs and enabled increased fitness for future generations.

Douglas³² describes two types of evolutionary scenarios that might explain the origins of symbiotic relationships. They include the transition mechanisms from antagonistic to mutualistic relations and partner capture. These events are complex, and many organism examples could be given to illustrate each. Antagonistic to mutual relationships may have happened by amelioration or addiction. *Amelioration* may happen when virulence decreases in a way that cooperation produces greater fitness for the parasite. *Addiction* may happen when one organism becomes dependent on a partner without benefit. Though symbiotic addiction has been observed and described, it does not seem to be prevalent. The other possible event is called *partner capture*, and that can occur when organisms with a history of symbiosis acquire a new partner, as in the case of mycorrhizal associations. Suffice it to say that biologists have observed countless examples of associations where the above events are plausible, and research is shedding light on the details of these complex associations, even at the genetic level. But what is often missing are the most complex questions of what detailed properties of each autonomous system must be necessary in order for them to interact in intimate and intricate ways.

An alternative design hypothesis for the origin of complex alliances

A philosophical naturalistic premise for the origin of life and biotic interactions includes randomness and abiogenesis/panspermia of the first cell. Systems are then assumed to self-organize (or self-reinforce) and increase in complexity via natural selection. As young-age creationists, we reject that premise in favour of the Genesis account of created kinds.³³ This has ramifications for the species concept issue, because species of creatures are the ones interacting in these close-knit relationships. If an original archetype (kind) of creature was created by a designer with intelligence and understanding, especially when it was designed to interact in complex systems, it is easy to see how conclusions drawn from extant systems could greatly differ from the



Photo courtesy of Tom Hennigan

Figure 2: A commensal relationship between resurrection fern (*Pleopeltis polypodioides*) and white oak (*Quercus alba*) in Northeast Georgia, USA. Because the fern is an epiphyte and grows on the oak, fern rhizomes and roots attach to the tree enabling it to grow off the ground and obtain water and nutrients from sediments on the tree and surrounding air.¹⁸ This benefits the fern by allowing it to gather more sunlight and be more protected from being stepped on and eaten. The tree is not harmed, nor is the fern taking nutrients from the tree. Resurrection comes from its ability to dehydrate to a state where it looks brown, shrivelled, and dead only to recover rapidly to a lush green state after a rainstorm. Much research is revealing greater understanding behind this ability.¹⁹ Some investigators are suggesting that commensal relationships are more complex than was thought, because interactions are dependent on groups of phenomena depending on ecological processes and relational components.²⁰

naturalist view. For example, a young-age creation model would predict the opposite progression from mutualistic relationships to relationships of suffering and harm (e.g. parasitism).^{34–37} Though evolutionary biologists have many different definitions for a species, the definitions are based on the faulty premise of dismissing the Genesis narrative. Therefore, when analyzing and drawing conclusions about ecological symbioses, it is imperative that creation biologists define the species in a way that is consistent with a biblically based/baraminological paradigm. This process has begun, and young-age creationists are in agreement that a biblical view of species, while rejecting species fixity and moving beyond essentialism, is a product of God's initial prototype.³⁸ These first organisms were designed to interact with others and fit into larger and more complex systems that would reflect God's invisible qualities of intelligence, unity, diversity, beauty, provision, and sustainment for all His creatures.^{39–41} These creation-based species concepts

suggest that a biblical/baraminological view of species has better explanatory power for phenomena such as ring species, Cenozoic species stasis, allopatric species, geographical heterogeneity, stable morphology in hybrid zones, cryptic/sibling species, and symbiotic relationships than Mayr's biological species and other evolution-based species concepts.

We want to emphasize that though organisms do have characteristics of autonomous molecular machines, they are connected and thrive on relationships, and relationship is an invisible attribute of God.⁴² As the above examples demonstrate, some of these interactions are good in that relationships are beneficial to all involved. Some of these relationships produce suffering and death for one or more symbionts and, in some situations, may move from mutually beneficial to antagonistic within the same life cycle. Evolutionary explanations lack the specific detail of the complex requirements that must happen in order for two or more autonomous organisms to enter into relationship. We believe that initially these relationships began with fully formed organisms designed to work together in very good ways, which is consistent with the Creator's relational nature but contradictory to an evolution model.⁴³ However, man's rebellion resulted in God cursing the ground, resulting in the negative consequences of suffering, disease, and death.^{44,45} All of these considerations are key scaffolding in a model of symbiotic relationships within the larger model of young-age creation.

Biblical life and death

Biological functions include systems that produce defining characteristics of living entities such as metabolism, growth, responding and modifying to environmental conditions, and reproduction. However, 'life' itself and consciousness seem to have attributes which are currently beyond the reach of scientific methods to explain how they originated. This is consistent with the idea that 'life' is not physical (not measurable) and originates in the Author of life who is also Spirit and not measurable.^{46,47} In the same way, biblical death may be more than cessation of life; it may include cessation of function and purpose for which it was created, which should drive deeper discussion of these issues regarding relationship design and parasitism/predation in an initially very good world.⁴⁸ Therefore, we focus on the task of making sense of biomolecular, physiological, or anatomical functions which have been proven decipherable. In fact, because these complex systems operate with such expected consistency, there is the growing tendency to explain biological functions using engineering or design principles. If diverse biological systems do consistently operate by principles similar to human-engineered systems, then these observations could naturally flow into the development of a model for symbiotic relationships.

Engineered biological design

Engineering principles are experimentally (or experientially) verified rules that must be incorporated into designs in order to get them to work for an intended purpose, or to achieve design characteristics such as efficiency, beauty, communication with two or more entities, and the exchange of resources.⁴⁸ If an engineer wanted to maximize the heat transfer between two fluids flowing through adjoining pipes, then the engineering principle would stipulate that fluids would flow in opposite directions by a principle known as countercurrent flow. Conversely, if an engineer observed a high transfer of heat between fluids in a biological setting, then their knowledge of engineering principles would guide them to suspect that a countercurrent flow system would be discovered. This countercurrent flow system has been discovered in many taxa.^{49–52} Research demonstrates a remarkable correspondence in design, purpose, and function for many organism systems with similar devices produced by human engineers.⁵³ Organisms are made of systems that often exploit the properties of ‘natural laws’ such as gravity, inertia, and momentum. (For a compelling talk that reinterprets ‘natural law’ as God’s intentional and active working throughout the universe, see Wise’s talk at a recent conference dealing with Historical Adam).⁵⁴

In the biology subdiscipline of biomimicry, human engineers regularly copy these systems and use them for inspiration in design and to improve human technology.⁵⁵ Some are calling for merging the fields of biology, computer science, and engineering, because terms and concepts from these disciplines are being applied in the biology laboratory.^{56,57} Engineering-inspired fields such as integrative systems biology, biomedical engineering, and synthetic biology have more in common with engineering approaches than with traditional biological ones.⁵⁸

Engineered biological design: working hypotheses and tenets

The rationale for developing a design model of symbiotic relationships would hardly suggest a ‘tweaking’ of current biological theory. Starting from an engineering basis would produce a radically different model. Previous creation models for programmed mediated design and rapid post-Flood intrabaraminic diversification may be consistent with the model discussed below.^{59,60} A design model of symbiotic relationships seeks to answer similar questions that current evolutionary theory tries to explain. These are: 1) How do we account for the apparent design of organisms suggested by their purposeful behaviours and exquisite fit of form and function? 2) Can nature function as an agent sufficient unto itself to produce life’s observed structure and function, or is an intelligent agent outside of nature needed? 3) Is the mechanism for organic change an independent and internally designed dynamic within organisms themselves, or is it the

external environment and its randomly variable conditions controlling mechanisms for change? 4) How does a design model of symbiotic relationships explain the suffering and pain that can come and go as organism interactions change from mutual, commensal, and parasitic if God is good?

We hypothesize that:

1. Biological functions will be accurately explained by models developed using engineering principles.
2. Studying human engineering practices will accurately inform biological research predictions and will direct researchers to precise characterizations of phenomena.

Moving biology into the realm of engineering may seem extreme, but we predict it will be how biology is practised by future generations of biologists. That said, these understandings do not take away from the wonder, beauty, emotional and spiritual experiences that come from exploring a forest trail, enjoying a beach sunset, contemplating the relational intelligence between mother bear and her cubs, or investigating the biomolecular interactions of tree roots and mycorrhizal hyphae. Wonder, beauty, curiosity, emotional wellness, and enjoying relationships with other beings are also part of God’s invisible qualities and are consistent with a very special world.

Computational biologist Sara-Jane Dunn gave a fascinating talk about her work at the interface between biology and computation.⁶¹ The distinction between basic biological research and its engineering applications, and who is doing either, is unclear. Thus, we now find some biologists and engineers focused on basic research and some in both fields concentrating on applications. Today, investigators acknowledge that research is best handled by a multi-disciplinary approach, but the future will likely see more of a uni-disciplinary approach where the fields are merged, and all must learn their craft by studying beyond their major academic disciplines.⁶²

Based on our hypothesis that studying human engineering practices will direct researchers to precise characterizations of phenomena, at least three tenets provide an engineering-based context for interpreting biological observations.

1. *Intentionality (teleology)*. Goal-directed activity to specific ends is observed in creatures essentially as a continuum from the molecular level to the whole organism, to the community, to the ecosystem. Rather than contrive explanations to work around this phenomenon, a design model of symbiotic relationships would characterize interpretations of biological systems in terms of their primary purpose and also embrace the search for ‘purpose’ as a useful guide to research agendas. ‘Top-down’ is the goal-directed approach humans use when designing systems. Thus, within a design model of symbiotic relationships, the ‘top-down’ rule for interpreting biological findings is seen as essential to correctly analyze systems.
2. *Internalistic*. All biological operations arise from identifiable control systems innate to the organism. The

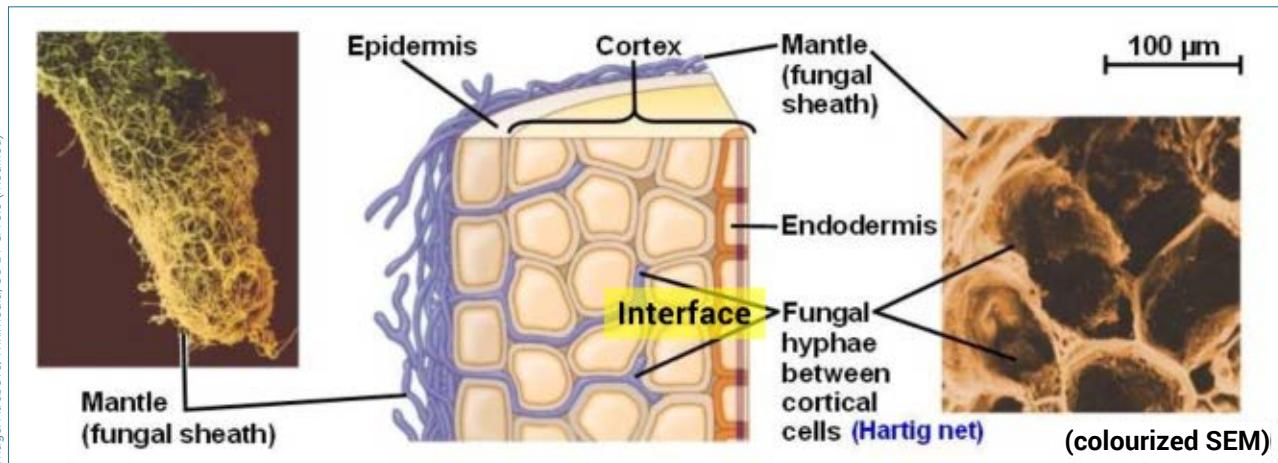


Figure 3. A mutual relationship between an ectomycorrhizal fungus and forest tree. Ectomycorrhizal fungi (ECM) are a type of mycorrhizal fungi that form a symbiotic relationship with most forest trees and supply them with nitrogen and phosphate, while the tree provides usable carbohydrates for the fungi.^{18,19} These nutrients are exchanged across a hyphal network interface called the Hartig net. According to the design MOSR, if one went searching for where the information that specifies harmonization of the ectomycorrhiza and forest tree roots resides, it would not be found within either, rather it comes from the mind of the Designer.

form and function of living entities are governed by innate systems. A rule for interpretation is that internal programming—not environmental conditions—will be credited for the successful solution to challenging exposures that may lead to differential survival and reproduction in a population.

3. *Individualistic.* Like all engineered entities, organisms are discreet individuals delineated by definite and distinct boundaries that distinguish ‘self’ from ‘non-self’. A design model of symbiotic relationships expects innate engineered controls will regulate organism–environment relationships as well as organism–organism relationships. An organism’s internal programming specifies (and restricts) only certain external conditions *to be* stimuli. Therefore, when interpreting how ‘self’ relates to ‘non-self’, individual organisms must be seen as *discreet elements* of broader systems called ‘ecosystems’. An accurate understanding of the ecosystem as a whole is obtained by accounting for the individual role of each kind of organism as a distinct element fitting within an extensive system. This contrasts with the view of many evolutionists, such as Steven Rose of The Open University, that blur the distinction between individuals and the ecosystem. Rose said, “There is no overriding reason why we should consider ‘the organism’ as an individual rather than ‘the group’ or even ‘the ecosystem’.”⁶³

An engineering-based model of symbiotic relationships (MOSR) recognizes that characteristics of ecosystems emerge from the contributions of each individual in relationship with one another. Individuality, therefore, is not obliterated by seeing creatures as being absorbed into an environmental collective. Thus, no matter how closely two (or more) individuals may operate together in what engineers may call a seamless

operation, a MOSR recognizes that there really is a seam and focuses research on what is happening at the seam. We predict that each individual organism will have an interface system that tightly controls how they relate to each other. It is the innate control of these relationships by each individual that determines the characteristic of the ecosystem. Therefore, a primary expectation of a MOSR is to discover corresponding system elements between human-designed contrivances and biological mechanisms performing similar functions. Evidence has been described supporting this prediction.^{7–9}

MOSR expects symbiotic relationships to be regulated by biological interfaces

Recognizing organism relationships is far from explaining the mechanisms enabling that relationship to happen. This is a fundamental question at the foundations of biology: how do two autonomous entities with distinct boundaries either work together or not?

Understanding symbiosis based on design analysis starts by looking for an analogous human-designed relationship, the mechanisms for operation of which are already understood, and seeing if there is a true correspondence between its constituent elements and those elements found within symbiotic biological relationships.

How could engineers overcome dissimilarities and get two autonomous entities with distinct boundaries to work together? There must be a bridging mechanism. A logical solution connects them via an interface. Prominent computer interface designers Kim Clark and Brian Petrin underscore the necessity of interfaces for cooperation. They emphasize that to understand an interface is to understand how autonomous entities can form intimate alliances and

cooperate with one another by communicating in such a way that information and product exchanges occur in a harmonious fashion.^{64,65}

Distinctive elements characterize interface systems

Designers use in-depth operational knowledge of both unrelated entities to integrate their functions into three indispensable interface elements: *authentication*, *protocols*, and a *common medium* of conditions mutually accessible to both entities. These three elements constitute the minimal components needed to attain basic functioning of an interface. Removal of any one of them causes an interface system to effectively cease functioning.

Authentication is a key mechanism used to recognize ‘self’ from ‘non-self’. Authentication is a highly regulated and extremely selective process that constitutes one element of an interface system. Systems or behaviours within individual organisms will function as an interface that often mandates disclosure of identifying information, validate that information, authenticate identities, and authorize exchanges with only select entities within an ecosystem.

Protocols are rules, processes, or mechanisms established by the interface designer that work between requestor and provider in order to *regulate* the relationship. Physical attachment often precedes control. If actual physical contact will be an element of control, protocols specify the physical conditions (i.e. for living things protocols specify the trait(s) that enable(s) physical attachment), which facilitate regulation through physical contact. Therefore, it is common that a *uniting element* fits together material elements at the boundaries of both entities like the Apollo-Soyuz docking station. One basic way for an autonomous entity (A) to produce a desired outcome from another entity (B) is for A to physically attach to B and take control over B.

There is another type of regulation between autonomous creatures that doesn’t involve physical contact. These outcomes are actually the consequential end product of each creature’s internal processes. The regulation starts when one creature detects specific conditions (i.e. stimuli) caused by another autonomous creature. It takes an elaborate design for one entity to present specific external conditions to an environment, which, when those conditions are detected by a second entity, responds by making a product that is useful to either the first entity or to the community as a whole. One example of highly complex interactions with little direct physical contact is earthworm multiple interactions in ecosystems. One study showed that they improve agroecosystem functions by improving and strengthening bacterial and small animal community interactions by indirect impacts that resulted in an improved and sustainable healthy growing environment for rice crops.⁶⁶

The *Common Medium* is a physical condition external to two or more entities. Each entity must have at least one

of its traits capable of interacting with the condition. For example, when humans speak to each other they use a common medium of air. Vocal cords, which can compress air into waves, are the trait of one person, and ear drums, which can sense compressed air waves, are the trait of the other person. Other common mediums are chemicals, electricity, or light. So, if the common medium is chemical, then each creature must have some trait that can produce and/or sense chemicals. So, we see a common medium is required in order to connect two autonomous systems and is therefore an absolute condition for an interface.⁶⁷

When observing certain organism symbionts, it could look like one species is directly controlling the other, but they are not. We need to remember how engineered interfaces work. Each organism has an interface, but the interfaces are only controlling the organism to which it belongs. This relationship is sometimes tricky to understand. Why? Because in mutualisms, harmonious outcomes are seen, but the interfaces that enable the harmonization aren’t seen. For example, when the fungal network interface of the Hartig net supplies nitrogen and phosphate resources to tree roots and tree roots supply carbohydrates to the fungus, it is easy to assume one might be controlling the other (see figure 3). This is not correct. The fungus and the tree root each control their own resource exchange. Selectionists assert that a long trial-and-error process of coevolution brought about the ability for two completely different taxa to help one another. An engineering-based MOSR would suggest that the immaterial information is controlling these physical operations within the fungus and the tree, which are two distinct, autonomous entities. In this case, if one went searching for where the information that specifies harmonization of the ectomycorrhiza and forest tree roots resides, it would not be found within either but comes from the mind of the Designer.⁶⁷

In a MOSR, parasitism and commensalism may be the result of the removal/dysfunction/mutation of one or more of the above elements of interface systems. In this view, parasitism is the *violation* of distinct boundaries of one entity upon another. This is in contrast to mutualism, which does not violate boundaries between entities.

Normally, free living nematodes seem to prefer to feed on one genus of bacteria, *Pseudomonas*, over other bacteria on which they routinely feed.⁶⁸ However, a nematode (*Caenorhabditis elegans*) that lives in soils of temperate regions learned to avoid the pathogenic species *Pseudomonas aeruginosa* and was able to transmit this learned avoidance for approximately four generations. The nematode can detect double-stranded RNA found in the pathogenic *P. aeruginosa* and it initiates a response. Investigators discovered that changes in the expression of a gene, *daf-7*, in a specific neuron called ASI, was a likely cause for the worm’s avoidance behaviour.⁶⁹ These researchers also found substantial changes in the small RNAs in the germline,

including the ones called Piwi-interacting RNA (piRNA). As the name suggests, piRNAs interact with *piwi* genes, which help to regulate stem cell differentiation. Thus, data suggests that the piRNA pathway is critical for inheritance of the behaviour.

The above example illustrates a complexity that far surpasses naturalistic explanations and is an excellent example for MOSR interpretation.

Conclusions

Based on human-engineered analogues, all relationships between biological entities are likely rooted in a basic interface design principle that enables them to interact with each other. Interface design is challenging. A mind is the only known origin of interface systems. It is an information-intensive task to devise physical or logical mechanisms to harmonize independent, often dissimilar, organisms. If God designed interface systems into creatures, then it is reasonable that their harmonious operation would greatly exceed anything humans have devised. Clark and Petrini underscore the importance of an interface designer's thorough knowledge of all systems.^{64–66} The Designer needs to understand all of the requirements of the requester while grasping all aspects of provider capabilities. Thus, for creatures to harmonize, the interface designer must foresee the outcome desired for each creature that will result from the relationship and have in-depth knowledge of their phenomenally complex systems. Given that all creatures seem to be linked into vast ecosystems, this indicates that the Engineer of all of these interfaces possesses an incomprehensible amount of knowledge.

The ecosystem–interface model is powerful confirmation for an engineering-based approach to symbiotic relationships. Evolutionists struggle to explain the origin of information for even an individual organism. But when it comes to highly interfaced relationships such as lichens, plants/pollinators, and mycorrhizal fungi, evolutionary naturalists must claim that these relationships were never elements of any overarching plans. Their solution is an appeal to everything coevolving together. When one reads 'coevolution' in evolutionary literature, then that should prompt a biological researcher to look for two or more interfaced organisms. But, if 'coevolution' amounts to no more than a declaration, then we must ask, where are the regulatory plans located for a world of innumerable and diverse ecosystems? From a model of symbiotic relationships viewpoint, they exist in the mind of the omniscient ecosystem Engineer, the Lord Jesus Christ.

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Puzzle of the missing angiosperms in the fossil record

Warren H. Johns

Conventional geology has yet to discover fossil angiosperm pollen, leaves, flowers, or wood *in situ* below the Cretaceous. The failure to find a long history of flowering plants prior to the Cretaceous is known as 'Darwin's abominable mystery'. However, creationists have also found this puzzling, and have advanced several arguments for pre-Cretaceous angiosperms.

Three major lines of evidence are scrutinized that are found in creationist literature purportedly supporting a pre-Cretaceous history of angiosperms: 1) The finding of fossil angiosperm pollen in the Precambrian and lower Paleozoic formations of Grand Canyon, USA; 2) the finding of angiosperm evidences such as cuticles in the Salt Range Formation of the Punjab, Pakistan; and 3) the discovery of purported Eocene pollen in the Roraima Formation (Precambrian) of Suriname (Dutch Guiana), South America. The best arguments advanced by creationists for the presence of angiosperm pollen and plant remains in the Precambrian are found to be lacking credibility.

Definitions

Angiosperms form one of two major branches of seed plants, the other being gymnosperms. Angiosperms receive their definition from their basic characteristic, having a seed composed of endosperm enclosed within a *case* or vessel (Gr. *angeion*). The Greek word for seed is *sperma*; hence, the derivation of the word angiosperm (*angeion + sperma*). The seed plants of the other major branch lack the enclosed seed; therefore, they are called gymnosperms ('naked-seeded'; Gr. *gumnos*). In angiosperms the fleshy case or vessel matures into the fruit, which encloses the seed or seeds. In Scripture the literal meaning of 'fruit' (Heb. *peri*) is a reference to the edible production of angiosperms, as in Genesis 1:11, but this word has taken on a much wider group of meanings through its metaphorical usage. The plant food source for humans consists almost entirely of the fruits, roots, and leaves of angiosperms. Today there are well over 300,000 species of flowering plants, making it by far the largest group of plants. By contrast, today's gymnosperms number just over 1,000 species. Only angiosperms have flowers; gymnosperms lack flowers and fruits.

Angiosperm pollen is unique and can be clearly identified, as can gymnosperm pollen (spores). Most other vascular plants, the non-seed plants, technically do not have pollen, but usually reproduction is based upon spores, as in mosses and ferns. Pollen is the male part of the plant and is enclosed in a highly resistant shell in which is the protoplasm containing the DNA and other elements needed for reproduction. The female part of the plant, the ovum, is stationary on the plants and must await the transfer of pollen to it in a process called *pollination*. Non-seed plants lack pollination. The male pollen is most often transferred by

either wind or animals (especially insects), explaining the need to have the pollen well-protected during its occasionally long-distance transport.

The cell wall of the pollen is composed of an extremely durable substance called sporopollenin, defined by *Wikipedia* as "one of the most chemically inert biological polymers",¹ which means it can rarely be broken down. Acidic soils, such as found in peat, preserve pollen extremely well. Highly alkaline soils do not. Rocks and minerals with a high pH (>9.0), such as lime, do not preserve pollen very well. Pollen does well under pressure, as when peat or other plant material is transformed into hard coal, but it can be destroyed by high levels of heat as in highly metamorphosed rocks. If angiosperms were in existence when Precambrian rocks were laid down, one would definitely expect pollen to survive the rigours of Earth history until the present.

Pollen in the Precambrian of Grand Canyon

The initial reports of pollen in the Precambrian (lowest strata) of Grand Canyon were the result of collecting efforts by creationist Clifford Burdick, who was pursuing a doctorate in geology at the University of Arizona.^{2,3} He studied under the tutelage of the world-renowned German-American palynologist, Gerhard Kremp, originally from Germany.⁴ A palynologist is one who studies fossil pollen and spores. Burdick's 1966 and 1972 reports published in issues of the *Creation Research Society Quarterly (CRSQ)* have microphotographs of fossil pollen from Precambrian and Paleozoic rocks in Grand Canyon.

Loma Linda University faculty and biology students wanted independent confirmation that the reported pollen was not the product of contamination, so they met with Burdick and collected additional samples from the same

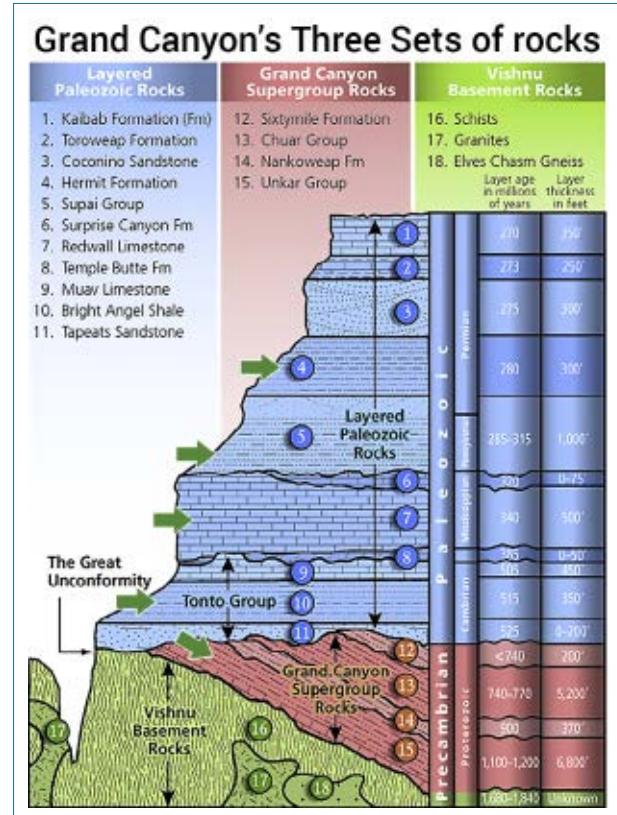


Figure 1. Schematic diagram of Grand Canyon formations with Precambrian formations tilted below the Tapeats Sandstone (Cambrian). Green arrows point to the portions of the Grand Canyon that are rich in shale rocks. The top shaly formation is the Hermit Shale, which has no reported pollen in any of the *CRSQ* reports. Airborne pollen cannot penetrate shale; hence, the Hermit is devoid of pollen. The other sites marked with green arrows have evidence of contamination with waterborne pollen.

original sites. Burdick accompanied them to the LLU palynology lab where he was able to process the additional samples using the same processing methods that he had relied upon previously. The Loma Linda group published the new findings, which resulted in a total failure to find fossil pollen in the same rocks.^{5,6} Their conclusion was that the samples had been contaminated, although Burdick disagreed with that assessment. To justify the possibility of finding pollen as low as the Precambrian rocks in Grand Canyon, Burdick published in *CRSQ* two brief news reports in which he cited other published reports of pollen being found in the Precambrian and lower Paleozoic throughout the world.^{7,8} The two best studies in these reports were from the Precambrian of the Punjab, Pakistan, and the Precambrian Formation of British Guiana, South America—both published in the leading journal *Nature*. Both sites with their findings will be addressed in our present study.

Four explanations can be offered to explain the contradictory findings between Burdick working from the University

of Arizona palynology laboratory and the Loma Linda University scientists, all of them creationists, working from the Loma Linda laboratory:

1. Contamination occurred in the laboratory due to careless laboratory methods.
2. Contamination occurred from careless handling of samples between the field and the laboratory.
3. Contamination of the samples was with modern pollen *prior* to the collection of the samples.
4. No contamination with pollen can be found because pollen was deposited *in situ* at the time that the Precambrian, Cambrian, and other Paleozoic sediments were deposited.

For creationists the preferred option is the fourth, which would cause some serious challenges for the system of geological dating. The present article questions whether the fourth option can be supported any longer. Options 1 and 2 are still supported by Leonard Brand, creationist and a colleague of Arthur Chadwick, who was the Loma Linda palynological expert who processed some of Burdick's samples in the 1970s.⁹

Perusing all the reports of Precambrian pollen in Grand Canyon, including subsequent reports published by other scientists in *CRSQ*,^{10–15} one can conclude that the pollen found and pictured in articles is not simply laboratory contamination. Also, it is highly unlikely that samples have been contaminated in the process of putting them in plastic bags and sealing the bags for transport. But what is acknowledged is that the pollen does not represent ancient pollen or pollen of extinct plants. It is modern pollen, most of which was from trees and herbs growing on the plateaus surrounding Grand Canyon. This alone strongly suggests the pollen is not *in situ*.

However, the rocks in which the pollen grains were found, shale, have low permeability, and this presents a challenge to any contamination thesis. The rock types where pollen has been found are (figure 1):

- Supai Formation (Permian)—sampling done on the shaly portion at the lowest Permian,
- Redwall Limestone (Mississippian)—sampling taken from the shaly portions of this limestone,
- Bright Angel Shale (Cambrian)—shale,
- Hakatai Shale (Precambrian)—shale.

Because of its very tight crystal structure shale is generally impervious to ground-water movement. Shale is the perfect capstone rock for trapping oil in rocks below the shale because oil cannot rise vertically through shale. That would also be true of ground-water movement—no vertical movement.

However, the crystal structure of shale is also very flat, which results in it splitting easily along lines of weakness.¹⁶ As such, in tectonically active areas such as the western United States, there has been a large amount of faulting. Some of the faulting would be along zones of weakness producing much horizontal movement in shale rocks. Only

in faulted areas could ground water flow through shale. Moreover, the predominant direction of flow would be *horizontal within the shale*, not vertical through it. Burdick does not comment on faulting in his publications, nor does he have any photographs of the outcrops where the samples are collected. His samples may have been collected where ground-water contamination has occurred.

Moreover, ground water exits from weeping rocks of Grand Canyon. Under rare conditions water could flow *into* the rocks along faulted lines of weakness, introducing contaminants such as pollen into the ground rocks. For instance, if Grand Canyon has ever been filled or partly filled with water, the shale of canyon walls could have absorbed water that was contaminated with the pollen that is ubiquitous where the canyon is exposed to the atmosphere. The North Rim of Grand Canyon is heavily forested with conifers, mostly pine (genus *Pinus*). Pines are some of the most prolific pollinators. During the spring pines surrounding a pond release pollen that collects as a yellowish powder on the windward side of the pond, sometimes a few centimetres thick. Grand Canyon *Pinus* pollen is pictured in creationist studies.¹⁷ The CRSQ follow-up study in 1988 pictures *Pinus* pollen as by far the most common pollen in the Hakatai (Precambrian) Shale.¹⁵ Likewise, *Pinus* is the most common forest tree on the plateau north of Grand Canyon.

Such conditions as may be suitable to ‘in the field’ contamination are suggested by the study of Austin and Rigg.¹⁸ They report that a total of 13 lava flows have dammed the Colorado River, forming large temporary lakes along the course of the river. The lava flows have been potassium-argon dated as Pleistocene. The tallest and oldest of the lava dams crested at 700 m above the current water level of the river, thus forming a backwater that extended 480 km. to Moab, Utah. The town of Moab is built next to the Colorado River and has an average elevation of about 1,220 m. The average elevation of the river in the canyon today is about 700 m. Thus, the lake formed by the largest lava dam was about 520 m (1,700 ft) above present river level. The resulting water level was high enough to bury the three lowest sites where Burdick found pollen. Natural lakes surrounded by some trees always have an abundance of pollen in the water column. A reverse process could likely have taken place whereby the shale buried by lake water absorbed occasional pollen grains in zones of weakness and faulted areas. The 13 lava flows, which are dated as Pleistocene, harmonize well with the identification of pollen found in shales as being Pleistocene. No extinct or ancient pollen, such as Paleozoic spores, have been found in any of the tested samples.

The highest elevation of the four collection sites was in the Supai at the lowermost Permian. Ancient temporary lake levels may have not reached that high, but rockslides and travertine deposits often have formed small ponds inside canyons, thus accounting for possible contamination in the Supai shaly portion of the Permian. The reports for

out-of-place pollen in Grand Canyon fail to give the various elevations at which samples were collected. What is different in the Supai samples collected by Burdick is the large proportion of conifer pollen—up to 20 conifer grains reported on one microscope slide. That’s to be expected because of the closer proximity to the pine pollen sources. By contrast, he could identify only half a dozen angiosperm pollen grains in total from the Supai.¹⁹

Perhaps other scenarios can explain the contamination of Paleozoic and Precambrian rocks with angiosperm pollen. Nevertheless, we must assume that the laboratory processing methods in most cases are not at fault. The conclusion of this review of all creationist studies in the search for pollen in the lowermost Grand Canyon is that there is no valid evidence for *in-situ* angiosperm pollen in the Precambrian or most of the Paleozoic. Indeed, the problem is greater than just Grand Canyon. Ten major geological formations lie above Grand Canyon before the first significant angiosperm pollen is found in the Dakota Formation (Albian-Cenomanian of the Cretaceous). See figure 2 for the cross-section of fifteen formations above the Kaibab Limestone at the Grand Canyon rim (northern Arizona), ending with Bryce Canyon (southern Utah) at the top. This is called ‘the Grand Staircase’, which represents about 1,520 m (5,000 ft) of sediments in addition to the approximately 1,520 m of Grand Canyon sediments. Creation geologists have noted the great thickness of Grand Staircase sediments lying on top of Grand Canyon sediments.^{20,21} Future studies will need to discuss possible reasons why no angiosperm pollen has been found in more than 2,130 m (7,000 ft) of flat-lying sediments of northern Arizona and southern Utah.

Precambrian/Cambrian pollen at two other geological sites

The two leading finds of Precambrian/Cambrian pollen cited by creationists are published in the prestigious journal *Nature*: 1) The discovery of Eocene pollen, spores, and cuticles in the Precambrian Salt Range Formation of the Punjab, Pakistan;^{22,23} and 2) the reporting of angiosperm pollen in the Precambrian Roraima Formation of British Guiana, South America.²⁴ Both of these findings have been given extensive notice in creationist publications. Paul Price recently has discussed the Salt Range report as an answer to the ‘Precambrian rabbit’ charge.²⁵ An expert on karst deposits, Emil Silvestru, has analyzed the Roraima Formation on the basis of its cave formation and other karstic evidence, concluding that pollen could not have intruded into the Precambrian metamorphic rock.²⁶ A much shorter discussion of this ‘pollen paradox’ was co-authored by Silvestru with Carl Wieland.²⁷ In non-peer-reviewed creationist literature a web article on pollen both in the Punjab Salt Range and the South American Roraima Formation has been authored by Sean Pitman, M.D.²⁸

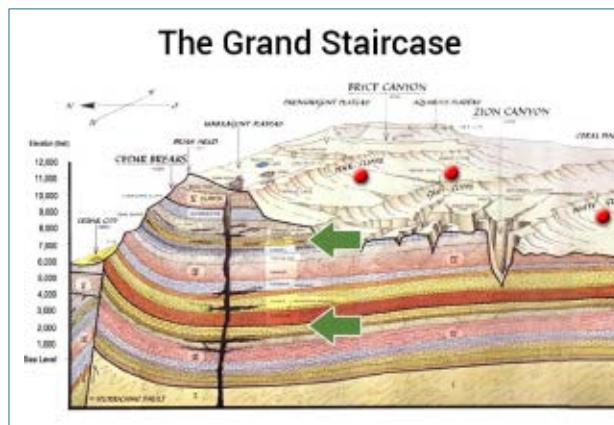


Figure 2. The Grand Staircase. A cross-section of the geological formations extending from Grand Canyon, Arizona (at the base) to Bryce Canyon, Utah approximately 240 km apart. The diagram represents 16 distinct formations. The earliest that angiosperm pollen is found in significant numbers is the Dakota Formation, more than halfway up the Staircase.

However, apparently the Punjab find can now be dismissed based on either laboratory or field contamination. Remains of angiosperms, such as cuticles and cell walls, have been reported throughout the 1940s in Salt Range deposits dated as Cambrian. This uncertainty and controversy continued throughout the 1980s. The angiosperms were representative of Eocene plants. How can they be both Eocene and Cambrian, when Cambrian has no other evidence of angiosperms around the world? The definitive answer to this dilemma was first published in 2017 by Nigel C. Hughes in an Indian paleobotanical journal.²⁹ All of the angiosperm evidences were fragile and fragmentary. Cuticle is the waxy coating on angiosperm leaves. Identification of cuticle is no longer accepted by paleobotanists as a valid way of identifying fossil angiosperms. They need the leaves themselves, not the waxy coverings. No angiosperm leaves have been found in the Precambrian or Cambrian of India and Pakistan. Hughes suggests contamination of samples, but does not speculate whether the contamination occurred in the laboratory or with collecting in the field.

The Roraima Formation (RF) with its pollen in Precambrian igneous rocks of British Guiana, South America is a more complex situation, but its explanation is similar to the explanation used for angiosperms appearing in the shale and shaly beds of Grand Canyon down to and including the Precambrian. Contamination may have been caused by ground water seeping between the bedding planes as in Grand Canyon. Silvestru adamantly denies ground-water contamination as an explanation.²⁶ The RF has both igneous and metamorphic rocks, especially in very thick sills (lateral intrusions). Generally metamorphic rocks can be impervious to ground water penetration, but not totally. Silvestru describes the rock as “compact, impervious hornfels rock”.³⁰ But then he debates whether it actually is impervious

because of the presence of limonite, an iron mineral very often associated with ground-water movements.

In years of collecting Paleozoic fossils in the Midwest of the U.S. the author has found frequent evidence of iron staining with limonite due to ground-water penetration. A quote from Stainforth, the author of the original *Nature* article reporting the sensational discovery of angiosperm pollen, notes cleavage “along finely laminated bedding planes which are coated with limonite.”³¹ Silvestru has skipped over the word ‘coated’, and instead has argued that the limonite was a primary feature in the rock (not post-depositionally added by ground water, thus contaminating the rock). A coating of limonite usually indicates ground-water flow. Also, Silvestru failed to cite any studies documenting ‘syngenetic’ limonite in Precambrian rocks. His use of the term syngenetic implies that the limonite formed at the same time the hydrothermal minerals were formed, not afterward. It is pure speculation to assume that limonite is syngenetic when it is so commonly formed with ground-water flow. And finally, from a creationist standpoint it should be noted that the formation where the pollen has been found has ‘finely laminated bedding planes’, just like the shale of Grand Canyon has formed finely laminated beds. If Grand Canyon Precambrian samples are now assumed to be the result of ground-water contamination along areas of weakness in bedding planes, then it is all the more likely that the Roraima Precambrian samples have resulted from the same type of ground-water contamination.

The conclusion is that all three of the major sites of purported Precambrian and Cambrian pollen can be now explained as contamination. The questionable evidence for Precambrian and Cambrian angiosperm pollen of Grand Canyon, the Punjab of Pakistan, and the Roraima Formation of South American should be added to the list of arguments that creationists should not use to support creation.³² Ruling out the *in-situ* pollen in Precambrian or Paleozoic rocks raises the question of whether any rocks below the Cretaceous have valid evidences of angiosperms.

Earliest valid evidence of angiosperms in the fossil record

A general consensus among paleobotanists is that no valid pre-Cretaceous evidence of angiosperms has been found as yet.³³ The latest assessment by expert paleobotanists is this:

“Critical scrutiny shows that supposed pre-Cretaceous angiosperms either represent other plant groups or lack features that might confidently assign them to the angiosperms.”³⁴

The Cretaceous is the highest of the three systems that comprise the Mesozoic. The apparently total lack of angiosperms prior to the depositing of Cretaceous rocks bothered Darwin, whose theory required a very long, gradual history of every major group of organisms from simple to

complex. The angiosperms do not have a single pre-angiosperm lineage leading up to the first valid angiosperms. The lack of a long history is known as ‘Darwin’s abominable mystery’. It has been a mystery ever since he first described it as a mystery in a letter to Joseph Hooker on 22 July 1879.³⁵ One encounters articles with titles, such as, “Darwin’s Mystery Is a Mystery Still”, well over a hundred years later in the scientific literature.^{36–38}

From a creationist viewpoint, angiosperms should exhibit a fossil history somewhat comparable to gymnosperms because of their being created at the same time. The earliest that gymnosperms appear in the geological record is in the upper Devonian, which is in the middle of the Paleozoic.³⁹ The earliest conifers, which are a subdivision of gymnosperms, are first found in the Upper Carboniferous.³⁹ Creationists have their own ‘abominable mystery’, and that is to explain why gymnosperms have an appearance in the geological record well below angiosperms, which presently are only in uppermost Mesozoic through Cenozoic rocks.

One creationist argument is that there have been reports of pre-Cretaceous angiosperm pollen in Lower Mesozoic (Triassic and Jurassic) rocks. True, there have been reports, but even if such are published in reputable journals that does not mean that such reports are supported by the general consensus of palynologists. Creationists have pointed to the supposed finding of six different types of angiosperm pollen from a Triassic borehole in Switzerland.^{40–43} The four microphotographs of ‘angiosperm-like pollen’ pictured in Brian Thomas’s analysis do not in any way look like the earliest valid angiosperm pollen in the Lower Cretaceous. The report of finding pollen in the Triassic has not discovered anything new; the Triassic has angiosperm-like pollen that palynologists call ‘pre-angiosperm pollen’. The authors of the Triassic find never claim that the plants were ancestors of any specific Cretaceous angiosperms.⁴⁴ Creationists have skipped over the last sentence in the report of six types of angiosperms in the Middle Triassic rocks:

“... we have to await discoveries of the corresponding megafossils to learn more about the morphology and relationship of the parent plants of the pollen grains here described.”

No leaves or any other megafossil can be assigned to the six types of pollen grains discovered. By contrast, leaves, stems, wood, fruit, and even flowers have been found for numerous angiosperm genera reported from the Cretaceous alone. It would be premature to elevate the Triassic finds to the same level as Cretaceous finds without well-documented megafossils to validate the six pollen types as being angiosperms, not pre-angiosperms.

The eminent palynologist, Valentin Krassilov, spent a lifetime studying angiosperms in the Cretaceous before he died in 2015.⁴⁵ His final major work was a 2012 study on the origin of angiosperms, in which he concluded there are no valid fossil angiosperms below the Aptian

of the Cretaceous, which is a stage near the base of the Cretaceous.⁴⁶ This definitive study is well illustrated with photographs of pollen as well as leaf fossils, which are needed for unquestioned angiosperm identification. The Triassic angiosperm-like pollen, being from a deep bore core, has no leaf fossils and is suspect. Had Krassilov included the Triassic evidence he would have labelled this as ‘proangiosperm’ or pre-angiosperm evidence, as he did for perhaps dozens of pre-Cretaceous fossils. A decade later reports of older angiosperms have been published, but these more recent finds are still Cretaceous. One important point is that Krassilov never pinpointed any pre-Cretaceous ancestor of angiosperms.

Many creationists share a common quest with evolutionists—to extend the fossil record of angiosperms much lower in the geological column. The failure for evolutionists to find a lengthy pre-Cretaceous history for angiosperms negates evolutionary gradualism and opens the door to the concept of ‘explosive evolution’ similar to the Cambrian ‘explosion’ when supposedly all the major phyla, both of plants and animals, came into existence in a fairly short period geologically speaking. For creationists all living things, plants and animals, came into existence within six literal days a few thousand years ago. The creationist ‘mystery’ then is why no apparent evidence exists for angiosperms in rocks that can be dated to the early post-Creation history of the earth or in the early history of the Genesis Flood. Further study is needed to unravel this mystery from a biblical perspective. The solution most likely will be biblical, not scientific.

Conclusion

At present, approximately the lowest three fourths of the fossil record have no valid evidence of angiosperm presence. The purported finding of angiosperm pollen in Precambrian and Cambrian rocks in Pakistan, Suriname, and Arizona can all be explained on the basis of contamination. The Pakistan study has been best explained as contamination due to substandard laboratory procedures. The Suriname and Grand Canyon studies are explained as post-depositional contamination by pollen-bearing water and should not be considered as having *in situ* pollen. What is lacking in all three studies is the finding of leaf or wood fossils from angiosperms in Precambrian and Cambrian through Permian rocks, that is, in rocks covering all Grand Canyon strata. Pollen is minute enough that it can be carried by water through tiny cracks and fissures into rocks generally considered impervious to ground water, such as shale and metamorphic rocks. Claims of four different types of angiosperm pollen being found in a Triassic borehole in Switzerland cannot be substantiated. Palynologists label those finds as ‘pre-angiosperm pollen’ because they do not possess all the characteristics of modern pollen. For any

pre-Cretaceous angiosperm pollen to be treated as valid, the reports would have to include leaf fossils. For readers of this journal, the lesson to be learned in this study is that the finding of angiosperms in the lower echelons of the fossil record, especially in Precambrian and Cambrian strata, is an argument that creationists should no longer use.

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The Victoria Institute—the forerunner of modern creation science organizations

Andrew Sibley

The Victoria Institute was the earliest creationist organization, founded in 1865. It later accepted old-earth creationism and theistic evolution. Early supporters favoured the Baconian scientific methodology, which involved experimentation and observations, and were sceptical of the hypothetico-deductive methodology that Darwin and Lyell used; they thought it too speculative. Their approach to science closely mirrors that of modern creation science organizations, which draw a distinction between testable operational science, and historical sciences that are untestable in real-time. Despite recent critics of creationism arguing that inspiration for creation science only arose with the Seventh Day Adventists in the 20th century, the early years of the Victoria Institute reveal that to be false.

The Victoria Institute, or Philosophical Society of Great Britain, was arguably the first creationist organization formed in order to oppose Darwinian evolution and support Christian belief (figure 1). It was founded in 1865, several years after the initial publication of Darwin's book *On the Origin of Species*. The main human drivers in the movement were the Scottish naval civil servant James Reddie, who became the first honorary secretary, and the Irish naval captain Edmund Fishbourne. Many leading gentlemen scientists joined the organisation, including the Earl of Shaftesbury, the first president, and the leading marine biologist Philip Henry Gosse (figure 2), who was one of the first of several vice-presidents.

The Victoria Institute was, from the beginning, only opposed to science that it considered to be false or highly speculative, and it defended the Scriptures against criticism. Officials and members were leading figures in British and Irish society (many from Trinity College, Dublin), including Sir George Stokes, who was president from 1886 until his death in 1903. Stokes also held the Lucasian professorship of mathematics at Cambridge from 1849 to 1903 (a post once held by Sir Isaac Newton) and was president of the Royal Society from 1885 to 1890 (figure 3).

Although the Institute's first papers defended a recent creation and Flood geology,¹ it later moved to accept old-earth creationism, and even theistic evolution, forgetting the reason for its foundation. As a result of acceptance of theistic evolution, a new movement, the *Evolution Protest Movement*, was formed in 1932 to challenge evolution, although remaining non-committal at that time regarding the age of the earth (but later accepting young-earth creationism; now known as the *Creation Science Movement*, which is based in Portsmouth, England).² Today, the Victoria Institute (under the name *Faith and Thought*) jointly publishes, with the organization Christians in Science, the journal *Science and Christian Belief*; this journal is dedicated to supporting

theistic evolution.³ The Victoria Institute has moved a long way from its founding principles.

Opposition to Lyell's geology and biblical criticism

Despite opposition to Darwinism, the Victoria Institute's first paper, by Reddie *Scientia Scientiarum*, did not mention Darwin's work.¹ Instead, it challenged Lyell's geological claims relating to the age of the earth, and the biblical criticism of Bishop John William Colenso⁴ (the 1860 work, *Essays and Reviews*, edited by John W. Parker, was also mentioned as a cause for concern). It was a lecture by Bishop Colenso in 1865 that had criticized the biblical text which sparked Reddie and Fishbourne to respond through the formation of a new organization. Anglican Bishop Colenso had been in London to defend himself against the charge of heresy, but he used the opportunity to engage in further controversy.

Colenso presented a paper at the Anthropological Society of London that raised questions relating to the integrity of the biblical text and the latest claims of geology. In the paper he commented that “the elementary truths of geological science” and “the simple facts revealed by modern science” were contradictory to “the accounts of the Creation and the Deluge”, so were “utterly irreconcilable with Scripture statements, if these are taken as announcing literal historical truth.”^{5,6} Reddie, and the vicar of Holy Trinity Brompton, Rev. W. J. Irons, were present. They strongly objected to these charges in a lengthy defence of the Bible, which even left Captain Fishbourne unable to speak.

The Victoria Institute supported Baconian science

The Victoria Institute certainly questioned aspects of Darwinism, but they did not spend a lot of time arguing against it in their first publications. Instead, members

Image: Flickr

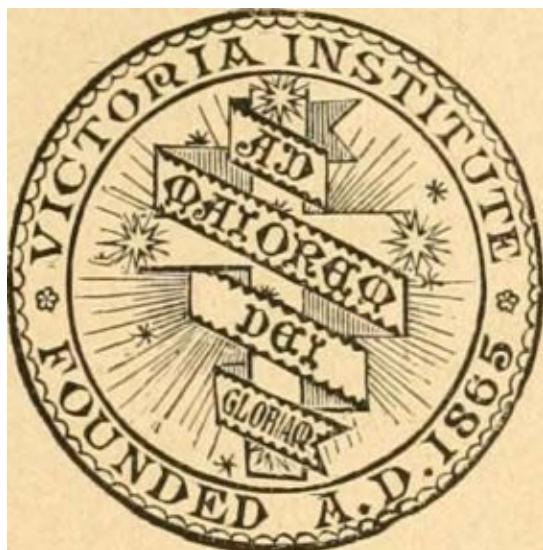


Figure 1. Seal of the Victoria Institute

were committed to defending philosophical and scientific commitments that supported the biblical text.⁶ Essentially, they were committed to the Baconian methodology of science. This approach valued empirical science, sensory experience, and inductive reasoning. In other words, they believed that science should progress through experimentation and the collection of data from observations. Through inductive inferences, general scientific laws and principles may be established.

The Institute's opposition to belief in deep time, Darwinism, and biblical criticism arose because they perceived the inherent hypothetico-deductive approach of proponents to be excessively speculative. So it was not worthy of acceptance as established scientific methodology (hypothetico-deductive reasoning involves stating a general hypothesis and then setting a test which is validated against data). The first 'Object' of the organization reads as follows:

"To investigate fully and impartially the most important questions of Philosophy and Science, but more especially those that bear upon the great truths revealed in Holy Scripture, with the view of defending these truths against the oppositions of Science, falsely so called."¹

The phrase "oppositions of science, falsely so called", references 1 Timothy 6:20 (King James Version): "O Timothy, keep that which is committed to thy trust, avoiding profane and vain babblings, and oppositions of science [gnōseōs γνώσεως] falsely so called [pseudōnymou ψευδωνύμου]."⁷

The first paper, *Scientia Scientiarum*, written by Reddie, mentions a Declaration of Students of the Natural and Physical Sciences that had been signed by 700 learned gentlemen students of science (see figure 4). Reddie

also commented that "science has become, in our day, materialistic and wildly speculative, entirely through a disregard of Lord Bacon's principles."¹ This demonstrates that, within the movement, there was a strong commitment to Baconian methodology as the only way to do science with integrity. Modern biblical creationists equally draw a distinction between operational science, which is based upon experiment and the historical sciences, which are untestable in real time.¹

Reddie also quoted Dean William Cockburn's 1844 defence of the literal reading of the Bible against the nebular theory; a theory that made claims about deep time relating to astronomy and geology (Dean Cockburn is one of the Scriptural geologists discussed in Terry Mortenson's research).⁸ It held that the earth had formed by the action of heat over long periods of time, thus rendering the Mosaic account in Genesis false. This theory was later abandoned, even by Lyell in 1864, because it was recognized that granite had been subject to cooling by water, thus (inadvertently for Lyell) supporting the biblical statements regarding a universal deluge. Reddie quoted the Dean's notes, that the Geological Society was "Most valuable, as having furnished us with unexpected and unanswerable proofs of the waters having once covered the existing earth."¹ Cockburn is quoted further by Reddie as follows:

"You say that there are geological facts which prove the long existence of the world through many ages. I say there are *no such facts*. Here we are completely and plainly at issue. Produce, then, some one or more of these facts; and if I cannot fairly account for them without supposing the very long duration of the earth, I am beaten! I am silenced! But if you do not produce such facts, and retreat, like Professor Sedgwick, from the challenge, confess, or let your silence confess, that the whole doctrine of a pre-Adamite world has been a mistake, too hastily adopted by men of talent and learning, and too apt, like all other persons, to draw general conclusions from a few particular facts [emphasis in original]."¹

However, Colenso had still used the nebular theory in his attack on the Bible in 1865—as Reddie observed:

"So that it would appear, that at that time, the 'orthodox' geologists taught that the facts of geology proved the universality of the deluge, which Bishop Colenso, on May 16th, 1865,—drawing his inspiration, no doubt, from what he now regards as geological science—declared to be 'an impossibility' in such absolute terms, as even to draw forth a disclaimer from the president of the Anthropological Society of London."¹

The Victoria Institute moves away from its founding principles

James Reddie died in 1871, and the movement began to compromise, with questioning over biblical interpretation.



Figure 2. Drawing of "British Sea-Anemone and Corals" by marine biologist Philip Henry Gosse, Plate V, Van Voorst, Paternoster Row, London, 1860

The later president, Sir George Stokes (figure 3), was a traditionalist Christian, but he suggested Christians may err in their interpretation of Scripture, particularly in relation to the Genesis creation account. However, Stokes equally questioned the reliability of scientific knowledge because it was at best probabilistic. He wrote:

"We all admit that the book of Nature and the book of Revelation come alike from God, and that consequently there can be no real discrepancy between the two if rightly interpreted. The provisions of Science and Revelation are, for the most part, so distinct that there is little chance of collision. But if an apparent discrepancy should arise, we have no right on principle, to exclude either in favour of the other. For however firmly convinced we may be of the truth of revelation, we must admit our liability to err as to the extent or interpretation of what is revealed; and however strong the scientific evidence in favour of a theory may be, we must remember that we are dealing with



Figure 3. Sir George Gabriel Stokes (13 August 1819–1 February 1903)

evidence which, in its nature, is probable only, and it is conceivable that wider scientific knowledge might lead us to alter our opinion."⁹

By the turn of the 20th century the Victoria Institute had abandoned a literal reading of Genesis 1. Roger Forster and Paul Marston write that "In 1914 E.W. Maunder summarised the then current views of Genesis 1 for the Victoria Institute—noting that recent creation was believed 'at one time' but no one now accepts it."¹⁰

False claims about biblical creationism

It is often claimed by evangelical Christians, such as Forster and Marston, that scientific defences of the Bible do not have a long tradition within Christianity. Sometimes, modern creationists are accused of being inspired only by the Seventh Day Adventist George McCready Price in the early 20th century.¹⁰ However, Forster and Marston, for example (as many others), follow geologist Michael Roberts,¹¹ and Ron Numbers (a professor of the history of science, but anti-creationist)¹² in arguing that young-earth creationism has its origins with the Seventh Day Adventists, and the eccentric founder and prophetess Ellen Gould White. They write:

"Many people today who adopt ... young-earthism ... do not realise what are its roots. They presume that they are acting in the general tradition of Evangelicals or of Fundamentalism. This is simply not so."¹⁰

It is true that Price became a member of the Victoria Institute in the 1920s and that he called the movement back towards a more literal interpretation of the Bible (which may have partly influenced the rise of the *Evolution Protest Movement* in 1932). However, as evidenced by the foundation of the Victoria Institute and the 19th century Scriptural geologists, the philosophical and theological foundations of modern creationism were already in place during the 19th century, and even centuries earlier.⁸

"We, the undersigned Students of the Natural Sciences, desire to express our sincere regret, that researches into scientific truth are perverted by some in our own times into occasion for casting doubt upon the Truth and Authenticity of the Holy Scriptures. We conceive that it is impossible for the Word of God, as written in the book of nature, and God's Word written in Holy Scripture, to contradict one another, however much they may appear to differ. We are not forgetful that Physical Science is not complete, but is only in a condition of progress, and that at present our finite reason enables us only to see as through a glass darkly; and we confidently believe that a time will come when the two records will be seen to agree in every particular. We cannot but deplore that Natural Science should be looked upon with suspicion by many who do not make a study of it, merely on account of the unadvised manner in which some are placing it in opposition to Holy Writ. We believe that it is the duty of every Scientific Student to investigate nature simply for the purpose of elucidating truth, and that if he finds that some of his results appear to be in contradiction to the Written Word, or rather to his own interpretations of it, which may be erroneous, he should not presumptuously affirm that his own conclusions must be right, and the statements of Scripture wrong; rather, leave the two side by side till it shall please God to allow us to see the manner in which they may be reconciled; and, instead of insisting upon the seeming differences between Science and the Scriptures, it would be as well to rest in faith upon the points in which they agree."

Figure 4. "Declaration of Students of the Natural and Physical Sciences", as quoted by Reddie in *Scientia Scientiarum*.¹

While Forster and Marston are clearly well acquainted with the Victoria Institute, they fail to draw out the significance of evidence that the early members generally held to a recent creation. They even note that the early foundation of the Victoria Institute involved belief in a recent creation, as the quote above, referring to E.W. Maunder, demonstrates. This evidence renders their categorical statement "This is simply not so", regarding the origin of young earth creationism, to be indefensible.

Conclusions

This article has only outlined the foundation of the Victoria Institute and its early position. However, it is evident that the scientific methodology of the early Victoria Institute is upheld within modern biblical creationism. The Victoria Institute's approach to science is clearly identifiable in the modern creation science position. This divides science; between the Baconian methodology, which involves experimentation, experience, and observation, and the speculative hypothetico-deductive approach of natural science, with its belief in deep time and evolution. Likewise, modern biblical creationists divide scientific methodology into operational science, which is widely accepted, and historical science, which is

considered speculative and unreliable when it contradicts the Bible.

It is true that the Seventh Day Adventist Price attempted to call the Victoria Institute back to its original position in the 1920s, but today's biblical creationists are really following an approach that already existed in the 19th century among leading evangelical Christians. Therefore, it cannot be claimed that modern biblical creationism has its roots only in the early 20th century, as Forster and Marston and others such as Roberts and Numbers try to maintain.

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What's wrong with being wrong: a closer look at evolutionary ethics—part 1

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Ethics is one of several disciplines within philosophy. Evolutionists have long grappled with the problem of how morality first arose. Suggested solutions are many, though all share a belief that morality (or a proto-morality) began in a non-human ancestor. Initially, this paper examines the major theories and explains why these attempts are pseudo-explanations and ultimately fail. What empirical data exist have been misused or question-begged into relevance. Subsequent parts focus on metaethics, neuroscience, logical fallacies generated by evolutionary metaethics, and finally a creationist model of metaethics. This first part throws a spotlight upon the intractable problems a naturalistic worldview generates accounting for morality.¹

"The secret of success is honesty and fair dealing. If you can fake those, you've got it made." (Groucho Marx)

In a canny Chip Dunham cartoon, a dog's master, pictured leaving his house, tells the canine that if it's good while he's away, on his return it will get some sausages, seen cooking on the stove in the background. With the master now absent, the next frame has the dog perched on top of several well-balanced objects, leaning over the stove and munching away. The dog's thought bubble says, "Oh, I'm good, pal." While the master in the cartoon is intending an ethical good, his pet interprets it as an instrumental one.

Dunham's quirky sketch soundly captures the problem ethical philosophers have struggled with throughout this discipline's lengthy history. As Mark Rowlands points out, there is often, though not necessarily, a great distance between what someone wants because they have interests which require satisfying and acts which are the ethically right (or wrong) thing to do.² As the cartoonist humorously highlighted, people regularly conflate *prudential* and *instrumental* reasons with *ethical* considerations for doing one thing rather than another.³ This difference will become sharply evident as the evolutionary explanations for acting morally are explored.

My multi-part paper will evaluate epistemologies, the 'how-and-what-we-know' metaphysics science, drawn from, or dependent on, an evolutionary worldview. This dovetails with an appraisal of the metaethical^{4,5} explanations which rely on an evolutionary aetiology, or, better still, ontology. Although operating within definitionally distinct realms, the ontological and epistemological will inevitably overlap as both share a common origins worldview.

Moral philosophers (and evolutionary scientists!) are divided over the source, the final ontological grounding of the ethical. Is it a brute fact, non-naturalistically 'existing' in its own world, not all that dissimilar from Plato's ideas? Is it an ultimate 'something' we cannot explain and must just accept? Or can the ethical be reduced to some non-ethical natural fact, like more effective survival or structures producing a more harmonious community?

One question which I will frequently return to is whether evolution could be a guide to moral difficulties. Attention will initially be focused upon altruism, a phenomenon counter-intuitive to the marrow of evolution. I will examine the 'solutions' the evolutionary biologist and philosopher propose to deal with this extraordinary enigma.

As a coda I will point out that a creationist explanation will obviate the inherent complications and contradictions of an ethics steeped in evolutionary materialism. My proposed model, taking metaethics in a direction grounded in the far more secure ontology of God's revealed nature, should be taken as a work in progress and not the final word.

My hope is that it will initiate discussion, either developing it further or critiquing it. As I've mentioned elsewhere,⁶ creationist ethical theory is urgently wanted and needs something more substantial, and acutely more apposite, than some reformulation of the hackneyed and woefully inadequate Divine Command Theory.^{7,8}

Evolutionists are saying what?

Richard Dawkins has rhetorically asked: "So why not just take the modern moral compass as it is, [it] having been worked out by moral philosophers and by a sort of discourse that takes place all the time as the centuries go by."⁹ Despite his and many others' belief that philosophers have

competently handled the ethics question, at least one notable evolutionist claims there is sufficient warrant “for ethics to be removed temporarily from the hands of the philosophers and biologized.”¹⁰ E.O. Wilson’s sometime collaborator, Michael Ruse, has concurred. In a partial washing-his-hands-of-it gesture, Ruse writes: “Frankly, I think there is only so far that a philosopher like myself can take the discussion. A naturalistic approach [to normative ethics] means … one puts oneself in the hands of the scientists.”¹¹

Stuart Kauffman boasted “Evolution is not the enemy of ethics but its first source.”¹² Despite Kauffman’s crow, for the evolutionary materialist, the origin and, especially, the justification of the ethical are insuperable problems. This quandary, ironically, also forms its trade secret; for, as the evolutionary biologist Michael Rose has written, “Darwinian theories of human nature are agreed that the ultimate foundation for human values is Darwinian fitness.”¹³ However ‘fitness’ is cashed out, the quagmire remains.

In opposition to Stephen Jay Gould’s insistence that evolution has no adverse implications for religion, as laid out in his Nonoverlapping Magisteria essay,¹⁴ it is clear from others that evolution attacks and then removes the very foundations of theism and traditional morality. One commentator, understanding that there is no peaceful coexistence, put it this way:

“Darwinism undermines both the idea that man is made in the image of God and the idea that man is a uniquely rational being. Furthermore, if Darwinism is correct, it is unlikely that any other support for the idea of human dignity will be found. The idea of human dignity turns out, therefore, to be the moral effluvium of a discredited metaphysics.”¹⁵

After listing a number of, as he called them, indisputable ‘facts’, Darwin laid an axe at the root of this idea, something Gould apparently could not grasp:

“The great principle of evolution stands up clear and

firm He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation I am aware that the assumed instinctive belief in God has been used by many persons as an argument for His existence. But this is a rash argument [and] I am aware that the conclusions arrived at in this work will be denounced by some as highly irreligious The birth both of the species and of the individual are equally parts of that grand sequence of events, which our minds refuse to accept as the result of blind chance.”¹⁶

The problem explained

The initial difficulty may be summed up roughly like this: how can something so suprasensible as morality, yet unquestionably real,¹⁷ be explained on the basis of a purely naturalistic worldview, the very metaphysical presumption that evolution is bound by? Indeed, this apparent incommensurability led Guy Kahane to note that “The worry that the theory of evolution is incompatible with morality and value is as old as the theory itself.”¹⁸

The paradox has not gone unnoticed by evolutionists, notwithstanding the overconfident trust placed in their worldview.¹⁹ Sharon Street sees the challenge as “explain[ing] the relation between these evolutionary influences on our evaluative attitudes . . . [and] independent evaluative truths.”²⁰ Stephen Macedo and Josiah Ober economically underscore the matter:

“How, given that there are strong scientific reasons to suppose that selfishness (at least at the genetic level) is a primary mechanism of natural selection, did we humans come to be so strongly attached to the value of goodness? Or, to put it a bit differently, why don’t we think it is good to be bad? For those who believe that morality is real, but that it cannot be explained or justified simply by resort to the theological assumption that a unique human propensity to goodness is a product of a divine grace, this is a hard problem, and an important one.”²¹

Another commentator unintentionally reveals just how epistemologically challenging it is when an evolutionary worldview and the existence of morality are brought together:

“I account for morality as an accidental capability produced,



Figure 1. Can evolution deliver any rock-solid certainty or is morality, at best, wishful thinking, a deceitful survival apparatus that ultimately places oneself ahead of others?

in its boundless stupidity, by a biological process which is normally opposed to the expression of such a capability.”²²

Charles Darwin understood how qualitatively special morality is, writing that it is the most important element that delineated man from beast.²³ Despite this, Darwin diminished morality’s ‘queerness’²⁴ by claiming that

“... any animal whatever, endowed with well-marked social instincts, the parental and filial affections being here included, would inevitably acquire a moral sense or conscience, as soon as its intellectual powers had become as well, or nearly as well developed, as in man.”²⁵

Indeed, nothing has changed: Darwin’s words are the bedrock mantra for contemporary belief. In a *Nature* opinion piece, the following was claimed:

“Morality is a product of evolutionary pressures that have shaped social cognitive and motivational mechanisms, which had already developed in human ancestors, into uniquely human forms of experience and behaviour. Non-human primates have a vast repertoire of social behaviours that can be interpreted as genuine forerunners of human morality.”²⁶

For anyone unfamiliar with the subject, the often quite abstruse and particularized discourse concerning the wished-for connect between evolution and morality buries and hides from public gaze an alarming issue. It’s not just a polemic axe for the creationist; even strident atheists are alerted to the parlous gravity involved:

“The recognition that our cognitive and motivational architecture is the product of natural selection raises the possibility that our moral concepts, moral intuitions, and moral sentiments might themselves be reflections of the evolutionary process. Indeed, this conclusion seems difficult to escape, given how natural selection works Natural selection favours designs on the basis of how well they promote their own reproduction, not on how well they promote moral behaviour.”²⁷

If our moral reactions are reduced to, and expressed by, the evolutionary process, there is a very real risk that evaluative vocabulary and meaning would be eliminated. For some, this is either inevitable or a very seductive alternative because it (at first blush) evades many of the problematic features associated with a naturalistic and material metaphysic. As one observer noted:

“If materialism is true, then human beings are large collections of small physical objects, and ontologically nothing more than that. It follows that any human being could be described, and described completely, in purely scientific terms.”²⁸

And so, the *moral* problem for the existence of morality is at last revealed: if our goodness and values are ultimately predicated upon what serves our (very much non-moral) best interests, then morality is a sham.²⁹

The blurring of boundaries: ethics and evolution [dis]connected

In its most pared-back form, the current naturalistic³⁰ view sculptures a somewhat romantic tale. Relying on that intellectual operation known as fog displacement, unnoticed and unrecorded in the temporally distant past, among a subgroup of non-human creatures or prehumans, proto-moral inheritable behaviours appeared. These were as a result of genetic mutation, presenting those creatures with a survival advantage over their contemporaries. Obviously convinced a liberal application of Ockham’s Razor will do the trick, the raconteur Daniel Dennett supplies the following exhaustive details for this event: “And then, one fine day, a mutation happened to arise.”³¹

With respect to early humans as the progenitor of morality,

“The received view among evolutionary theorists who believe that human morality can be given a selectionist explanation goes roughly like this. Morality developed and spread among small, scattered hunter-gatherer groups in the middle-to-late Pleistocene, where

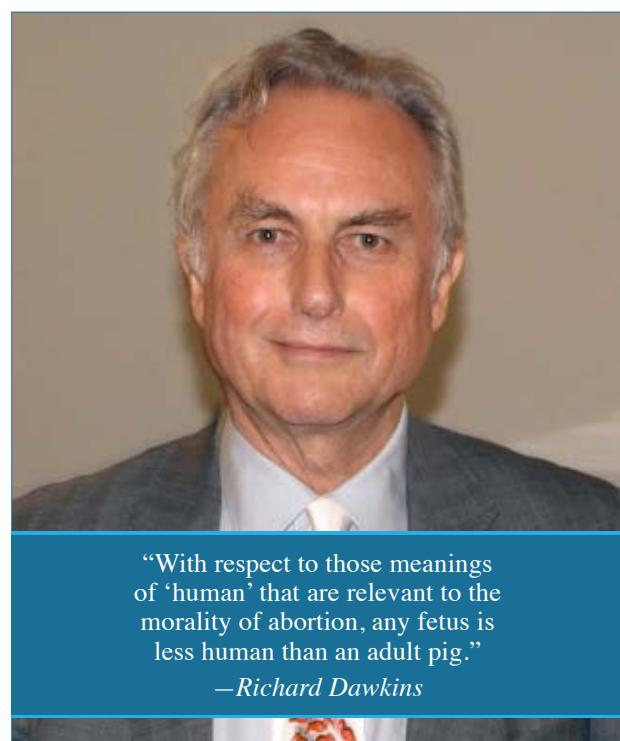


Image: Name / Wikipedia, CC BY 3.0 [modified]

Figure 2. Dawkins’ ‘moral’ compass can only lead to the dehumanisation of humans, as per his own words.

it was selected for the effect of managing patterns of interaction that resulted in costly intragroup conflicts. In particular, morality helped solve collective action problems by reducing free-riding, enabling individuals to resist temptations to act selfishly, and preventing dominant individuals from monopolizing the fruits of cooperation—generating an evolutionary return that was greater for each individual than would have been possible if each had acted alone or as part of a group that did not cooperate effectively. The fruits of cooperation included (*inter alia*) higher foraging yields, enhanced warfare capabilities, territorial acquisition, the efficient management of common resources, and the resolution of internal disputes.”³²

Despite stressing the importance of empirically based data to secure their argument, the appeal to a just so story is given preference over evidence:

“There is, however, broad agreement on the basic Darwinian logic: in a population of competing cultural groups subject to the climatic upheavals of the late Pleistocene, those that developed effective moralities, that is, moralities that were capable of avoiding the costs associated with cooperation failures, were more likely to pump hominins into the next generation, to persist as groups, to sustain and transmit their social structures, and/or to give rise to offspring groups. These ecological conditions, so the argument goes, conferred a reasonably high probability on the evolution of morality in broad strokes, and go some way toward explaining its more specific contours, such as our evaluative attitudes toward kin, kith, strangers, patriots, nonreciprocators, gluttons, cheats, murderers, and the like.”³³

“Moral attitudes, and structures within animals which make them possible”, Donald Broom writes,

“... have not persisted in populations by chance but because those individuals which had them gained selective advantage from having them. The basis for this is that certain genes would promote moral acts and those genes which interact with the environment to produce beneficial characters in the phenotype of the animal are more likely to persist in the population.”³⁴

In other words, there must be a statistical bias in favour of this mutation’s survival and spread throughout the population. The appearance in primates of a brain with sufficiently complex emotional and/or ratiocination faculties permitted these initial survival advantages to be eventually expanded and transformed to a fully functioning moral capacity.³⁵

Quite often the knotty naturalistic processes of how morality came to be are simply question-begged into existence.³⁶ For example, Mary Maxwell writes:

“Our moral sensibility is a ‘given’, and because

of it we can construct moral opinions. Later in time, rule-making and the formulation of ethical principle become established as cultural institutions, but in the first instance they are based on human nature. [A] sense of morality is also instinctive.”³⁷

Likewise, Catherine Wilson assumes

“... morality is a naturally occurring phenomenon that has a foundation in native human dispositions and in the exigencies of our lives as social animals, both of which are subjects for naturalistic inquiry. [M] orality [is to be understood] in terms of a biologically determined proto-moral core and an ideational hypermoral periphery.”³⁸

Despite the declarations of certitude, examination of the supporting evolutionary arguments leaves no doubt that gaping lacunae exist and are the best verbal legerdemain.

“The greatest mystery is not that we have been flung at random among the profusion of the earth and the galaxy of the stars, but that in this prison we can fashion images of ourselves sufficiently powerful to deny our nothingness.”
(Malraux, A., *The Walnut Trees of Altenburg*, Fielding AW (trans.), John Lehman, NY, p. 74, 1919.)

Altruism³⁹—a self-refuting concept

According to evolutionary theory, fitness, properly conceived, is measured by the reproductive success of how well an individual’s genes are passed on to subsequent generations.⁴⁰ If, on average, there was a net fitness cost to an individual bearing the hypothesized altruistic genotype, compared to others in the population, then altruism could never spread. Yet, population genetics maintains that only if the mean fitness of an encoded altruistic trait is higher can it increase in numbers in the greater population. And herein lies the puzzling nature of the existence of altruism. Altruism, understood biologically, must then come at a cost to the benefactor while enhancing the fitness of another.

With respect to this enigma, Edward O. Wilson raises the following query: “Altruism is ordinarily defined as self-destructive behaviour performed for the benefit of others How can altruism, which by definition reduces personal fitness, possibly evolve by natural selection?”⁴¹ Lauren Wispé likewise probes, “How can genes that lead to less of me (the altruist) lead to more of us (altruists)?”⁴²

The paradox is clear: any individual carrying a gene or genes for altruism would work against its own reproductive success, contradicting evolution’s criterion of fitness. Oren Harman bluntly exposes the self-refuting dilemma for evolutionary theory by asking, “If altruism evolved over time in nature, it surely must have served some utilitarian purpose, and if it serves an ulterior purpose it is never what it seems.”⁴³

In other words, the altruistic ‘good’ is not irreducibly good but becomes something other than good for good’s sake.⁴⁴

Divide and conquer

In order to explain altruism’s rise and subsequent spread, evolutionists distinguish between psychological and biological altruism.⁴⁵ Psychological altruism is the commonplace understanding of an unselfish regard for others, the type that motivates to “not even let your left hand know what your right hand is doing”. The biological variety is “behaviour which is likely to increase the reproductive output of another member of the same species. ... and which at least

“When I use a word it means just what I choose it to mean – neither more nor less.” (Lewis Carroll, *Through the Looking-Glass*, as spoken by Humpty Dumpty.)

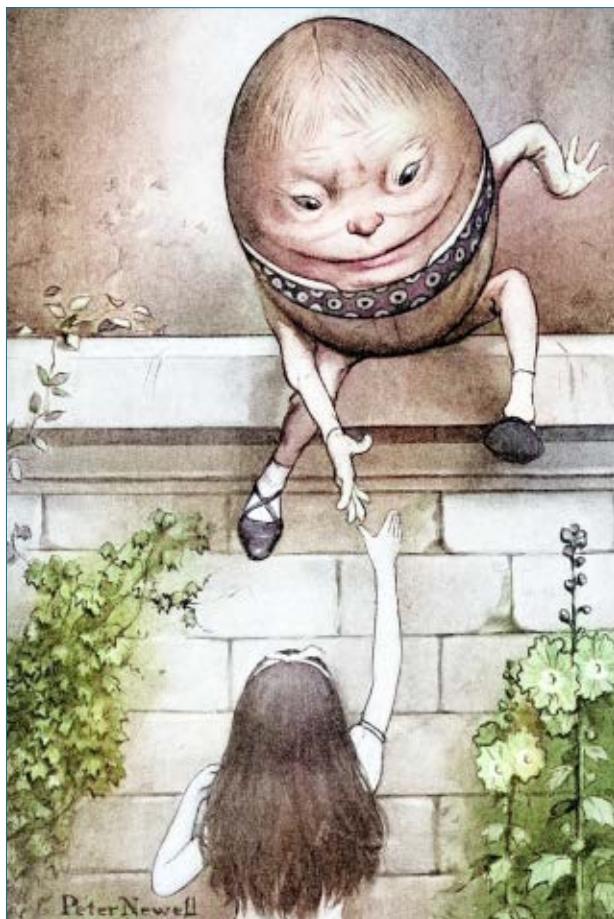


Figure 3. “And he grinned almost from ear to ear”. Illustration by Peter Newell to *Through the Looking-Glass and What Alice Found There* (Lewis Carroll, 1902).

in the short term is likely also to reduce the number of the actor’s own descendants.”⁴⁶

Biological altruism is predicated upon the assumed historical truth that the antecedents for human psychological altruism originate in the non-human realm. Evolutionary biologists and philosophers broadly agree that biological altruism is not unique to humans but rather can be detected in a kind of continuum which stretches through non-vertebrates to the higher life forms. Intention, an ostension of mind, does not have to be present in order for biological altruistic behaviour to be demonstrated. Instead, it’s the means to a biological end that defines whether or not some action is altruistic or not. For example, E.O. Wilson describes how injured *Solenopsis invicta* worker ants, appearing more aggressive than their uninjured sisters, leave their nests to stave off invasion. Drawing a long, though veiled, anthropomorphic bow, he claims that “[these ants’ action] may be no more than nonadaptive epiphenomena, but it is also likely that the responses are altruistic.”⁴⁷

Two things need to be kept in mind. Not all evolutionists agree that psychological altruism is real. However, all adhere to at least one, in some cases just about all, of many explanations (several of which I will address in subsequent parts) of how biological altruism obtained a foothold and how it then may have led to the rise of the psychological variety. Second, any proposal for the genesis of altruism is predicated on the imputed reliability of the model(s) that was chosen.⁴⁸

Conclusion

Evolution-based explanations for morality serially circumvent the purely non-material quiddity of ethics. This failure has meant that ethicists are forced to reduce or redefine morality to a naturalistic something else, a something which clearly has nothing to do with what makes morality so metaphysically unique. Whether it’s, *inter alia*, in terms of reproductive success, an accident of chance or a utilitarian by-product, all have failed to honestly deal with this purely human (and godly!) core truth. Furthermore, morality, which is best explained as seeking the best for others at the expense of yourself, contradicts evolution’s keynote demand of putting genetically more of yourself into subsequent generations.

In the next part, I will examine the once leading explanation for the rise of morality, group selection. Both Wallace and Darwin held it in high esteem. Despite its decline as an explanation since the 1960s, there has been a small number of contemporary philosophers and scientists who have revived it as a worthwhile account for morality’s rise and continued existence.⁴⁹

References

- Technically, there is a difference between ‘morality’ and ‘ethics’. I won’t be concerned with this here and will continue to use the two interchangeably.
- Rowlands, M., *The Philosopher at the End of the Universe: Philosophy explained through science fiction films*, Thomas Dunne Books, NY, pp. 158–159, 2004. Rowlands’ book is delightfully clever and extremely humorous. It comes with high praise for being able to present philosophy in a very approachable manner.
- For an adequate, though lengthy, historical overview of early modern ethical philosophy and these problems, see Korsgaard, C.M., *The Sources of Normativity*, Cambridge University Press, Cambridge, pp. 7–48, 1996.
- Metaethical enquiries ask what is going on in ethical evaluation and focus on moral concepts (such as ‘wrong’, ‘right’, ‘ought’, ‘good’) and the structure of, and justification for, moral reasoning. Metaethics is in contradistinction to normative ethics, which enquires about what one should do and acts as a guide for behaviour.
- Regarding this, it is of significant interest to note Allen Buchanan’s comment regarding human rights. He notes there is a “justification deficit, the disturbing fact that, while the global culture and institutionalization of human rights are gaining considerable traction, the nature of the justification for claims about the existence of human rights remains obscure.” Buchanan, A., The egalitarianism of human rights, *Ethics* 120(4):679–680, July 2010. While an address of international human rights lies outside this paper’s stated goals, it is conceivable that this deficiency may be as a result of the inability of evolution to provide a convincing metaethical justification for any ethical demand, let alone something so august as a global theory of justice. What’s left—and this is amply illuminated in Buchanan’s analysis—is a non-moral justification relying on instrumental reasons, question-begging equal status or equally circular personhood dignity claims grounded in a respect for a person’s normative agency.
- Kay, M., Darwinian foundation of modern ethics, *J. Creation* 18(1):41, 2004. One possibility I won’t be addressing is explanations (are there any?) assuming a theistic evolution ‘creation’ account. As Wilder-Smith pointed out, God using evolution would mean that God put His wisdom in His pocket and worked by chance. How is it conceivable that the most intelligent Being would set aside His intellect and work by non-intelligence? This involves no less a contradiction for an evolutionary ethics in which a proponent of such a thesis requires a theodicy where death and suffering are a given, but also a deity who is loving and moral. It has been my experience that theistic evolutionists seldom discuss these problems, and, if they do, are far more supportive of the evolutionary component than the theistic one.
- The Divine Command Theory (DCT) is a metaethical system that states our moral duty is referenced to our obligations to God and His moral commands. Beginning with Plato’s *Euthyphro*, there has been much criticism of the DCT, and more again responding to these criticisms, which attempt to rejuvenate the theory. (See, for example, Rooney, P., Divine commands and arbitrariness, *Religious Studies* 31(2):149–165, June 1995; and Adams, R.M., *Finite and Infinite Goods: A framework for ethics*, Oxford University Press, NY, pp. 250–276, 1999.) In his *Euthyphro* dialogue, Plato put the Divine Command theorist on the horns of a dilemma: either God commands something because it is right, and thus God drops out of the picture because rightness is a given, or something is right because God commands it, making rightness seem arbitrary.
- One inadequate defence of the DCT arises from William Lane Craig’s debate with the philosopher Erik Wielenberg. Craig argues we have an obligation to God to follow His commands because His commands should be followed. Something of being explanatorily short-changed can be understood from His response to being asked why we should obey God’s commands, where this ‘should’ comes from and how this ‘should’ is grounded in God. His unsatisfying answer is that the DCT is the explanatory ultimate in as much as “the divine commands constitute our moral obligation” and the question of why one should obey God’s commands doesn’t even arise because this is just the theory the DC theorist is proposing. Worse still, Craig proposes that we should obey God’s commands because God has commanded us to obey His commands. He not only denies this is a viciously circular proposition but determines it a brute fact. (William Lane Craig v Erik Wielenberg, “God & Morality”, North Carolina State University, Feb 2018, [youtube.com/watch?v=xHhmugBW6Dw](https://www.youtube.com/watch?v=xHhmugBW6Dw) from c. 1 h 58 m mark. Last downloaded 11 Feb 2022.)
- While a footnote would insufficiently cover the scope of Adams’ lengthy argument’s shortcomings, a brief excursus is appropriate.
- My challenge to Robert Adams’ and others’ attempted vindication of DCT is not that God’s commands are understood as arbitrary, one half of the customary criticism. Rather, the salient problem arising out of a metaethics conceived from the DCT is that its proponents inadequately, if ever, solicit God’s *revealed* and *biblical* ontological grounding or nature. They tend to play on a pagan field, and Adams makes no attempt to disguise his theory’s real epistemological and ontological source. He proudly admits, “my framework is broadly Platonic as well as theistic. … On my theistic adaption of Plato” (ref. 7, p. 4). He slams the door shut on any apologetic for God’s existence (“I will not attempt anything I would call a ‘proof’ of the existence of God” p. 28), but instead opts for a question-begging reformulation of God’s ontology as the Platonic ‘supreme Good’ or the pleonastic ‘Excellence’ (p. 28 and *passim*). Presupposing the theory and eschewing any explanation of God’s nature, he fails to build an epistemological bridge between the commands of God and God’s nature.
- At best, all that can be squeezed from this non-Christian spirit is “a God who is supremely excellent in being, in commanding, and more generally in relating to us, whose commands can plausibly be regarded as constituting moral obligation” (p. 255). This lifeless, cold something is what has come to be expected from a theory so heavily dependent upon paganism generally and Platonic idealism more specifically. Such a good appears far too impersonal, yet ethics inextricably involves the personal.
- Building on this syncretism, Adams, rather than making ‘love’ the ontological identification of God, as per 1 John 4:8, 16, attenuates revelation by merely giving “God’s love *a part* to play in explaining the nature of excellence [emphasis added]”. Here he prioritizes the Platonic and subordinates the revelatory ‘love’. What connection, he asks, is there between this mooted excellence and God’s now circumscribed and resituated love? The thread is that it is “excellent to value the excellent”, which seems as illuminating as the tautological ‘red roses are red’. ‘Excellence’ obtains a ‘primary place’ in his metaethical theory, not only lying at the “heart of Platonic conceptions” but central to his theism (p. 83).
- I will have more to say regarding Adams and the DCT in the final part to my paper.
- I thank an anonymous reviewer for drawing my attention to this deficient explanation in the paper’s introduction.
- Quoted from Robinson, P., You don’t get your moral compass from religion, creation.com/moral-compass-religion. Originally sourced from Richard Dawkins’ interview, Morality has nothing to do with religion, 14 October 2015, found at businessinsider.com/richard-dawkins-religion-morality-2015-10.
- Wilson, E.O., *Sociobiology: The New Synthesis*, The Belknap Press of Harvard University Press, Cambridge, MA, p. 562, 2000. Wilson is not a lone voice calling for this project. Philosopher William Casebeer writes that “useful interactions between [evolutionary biology] and ethics is the critical issue facing the sciences [in order] to cast about for a post-Enlightenment normative anchor … to prevent backsliding into dogmatic supernatural and non-naturalistic conceptions of the moral life.” (Casebeer, W., *Natural Ethical Facts: Evolution, connectionism, and moral cognition*, The MIT Press, Cambridge MA, p. 1, 2003.)
- Ruse, M., Is Darwinian metaethics possible (and if it is, is it well taken)?; in: Boniolo, G. and De Anna, G. (Eds.), *Evolutionary Ethics and Contemporary Biology*, Cambridge University Press, Cambridge, p. 14, 2006.
- Kauffman, S.A., *Reinventing the Sacred: A new view of science, reason and religion*, Basic Books, NY, p. 260, 2008.
- Rose, M.R., *Darwin’s Spectre: Evolutionary biology in the modern world*, Princeton University Press, Princeton, NJ, p. 185, 1998.
- Gould, S.J., Nonoverlapping magisteria, *Natural History* 106(2):16–22, March 1997.
- Rachels, J., *Created From Animals: The moral implications of Darwinism*, Oxford University Press, Oxford, p. 5, 1991. This non-uniqueness was also an important axiom of Darwin’s theory. He opined that “there is no fundamental difference between man and the higher mammals in their mental faculties.” Darwin, C., *The Descent of Man, and Selection in Relation to Sex*, Penguin Books, London, p. 86, 2004. It is obvious that if, as the actual facts clearly highlight, humans and higher mammals were poles apart in their mental dispositions, evolution would have an extra and insurmountable burden to overcome. By axiomatizing the unmistakable gap out of existence, a considerable part of the appearance of morality can be avoided. Herbert Spencer was quick to jump on the bandwagon. He saw in Darwin’s grand scheme a way of eliminating Christian morality: “Now that moral injunctions are losing the authority given by their sacred origin the secularization of morals is becoming imperative.” Spencer, H., *The Data of Ethics*, Williams and Norgate, London, p. 5 (p. iv in original), 1879. https://oll-resources.s3.us-east-2.amazonaws.com/oll3/store/titles/331/Spencer_0622_EBk_v6.0.pdf, accessed 20 Sep, 2021.
- Darwin, C., ref. 15, pp. 676, 682–683.
- The realness of ethics, I suggest, is discovered in their normative force and not in their descriptive quality. As Christine Korsgaard notes, “They make *claims* on us; they command, oblige, recommend, or guide [and] when we invoke them, we make claims on one another.” Korsgaard, C.M., *The Sources of Normativity*, Cambridge University Press, Cambridge, p. 8, 1996.
- Kahane, G., Evolutionary Debunking Arguments, *Noûs* 45(1):103–125, March 2011; p. 103.

19. In case you have overlooked just how pivotal the materialist ideology is to the discipline of ethics, consider the following remark. Two principal commentators, rejecting any ‘extrasomatic’ or divine source for morality, claim “Everything human, including the mind and culture, has material base and originated during the evolution of the human genetic constitution and its interaction with the environment [and] the human condition can eventually be understood to its foundations, including the sources of moral reasoning.” (Ruse, M. and Wilson, E.O., Moral philosophy as applied science, *Philosophy* 61(236):173–174, April 1986.) Yet, there is also a view of the mind’s appearance which in just about any other setting would be viewed as magical. I claim ‘magical’ as a kind of *quid pro quo* rebuke for evolutionists’ similar responses to creationist explanations. For example, “We believe that the secret of the mind’s emergence lies in the activation of a mechanism both obedient to physical laws and unique to the human species. Somehow the evolving species kindled a Promethean fire, a self-sustaining reaction that carried humanity beyond the previous limits of biology. This largely unknown evolutionary process . . .” (Lumsden, C.J. and Wilson, E.O., *Promethean Fire: Reflections on the Origin of Mind*, Harvard University Press, Cambridge MS, p. 19, 1983.) Hey, if God doesn’t quite intellectually do it for you, why not call down a demi-god! The book’s drawings should be an embarrassing reminder to any fair-minded evolutionist that their ideological family hatches some fairly absurd material from time to time. The authors’ attempts of ‘historical’ construction are a farago of overactive artistic fantasy and downright risible nonsense. My favourite is a Cro-Magnon woman, mouth closed, yet representing the sound of ‘em’ because her hand mirrors the act of clasping an object. It took me a while to get it, but I think her thumb, forefinger, and object held between them form the three-pronged shape of an ‘m’. The wonderfully accurate drawing, however, does come with a rider: “This example is based on the speculative reconstruction of the early evolution of language.” As I said, risible.

20. Street, S., A Darwinian dilemma for realist theories of value, *Philosophical Studies* 127(1):109, January 2006. Although her criticism is directed toward realist theories, the problem is no less relevant for the non-realist, as she herself admits and grapples with. Despite her rejection of relativism, the apparent logical consequence of being both an evolutionist and a non-realist, it’s awfully difficult to see any other choices available apart from this or some form of moral nihilism.

21. Macedo, S. and Ober, J. (Eds.), Introduction to de Waal, F.; in: *Primates and Philosophers: How morality evolved*, Princeton University Press, Princeton NJ, pp. x–xi, 2006.

22. Williams, G.C., Reply to comments on ‘Huxley’s evolution and ethics in sociobiological perspective’, *Zygon* 23(4):437–438, December 1988, as cited in Broom, D.M., *The Evolution of Morality and Religion*, Cambridge University Press, Cambridge, p. 12, 2003.

23. Darwin, ref. 15, p. 120. Just to put the reader on notice, I almost completely avoid reference to Darwin’s writing on the matter. While contemporary discussion is far more nuanced and sophisticated than Darwin’s, there is no genuine advance on his ideas. Despite repositioning ethics to the world of genetics, a world that Darwin had no idea about, contemporary explanations are still beholden to all the inescapable errors and fallacies that he was. Darwin’s explanation for the rise of morality is principally located in his fourth chapter of *The Descent*. A summary of this can be read in Tim Lewens’ *Darwin*, Routledge, London, pp. 162–171, 2007.

24. John Mackie coined the expression due to his not, for various reasons, holding to an objective realist metaethic. See Mackie, J.L., *Ethics: Inventing right and wrong*, Penguin Books, NY, 1977. For further understanding of Mackie’s argument for an antirealist morality from its perceived ‘queerness’, see plato.stanford.edu/entries/moral-anti-realism/#ErrThe, accessed 20 September 2021.

25. Darwin, ref. 15, pp. 120–121. Darwin appears to have left no clue as to whether or not he was fully aware of the difficulty of producing a believable account of how morality could have arisen *de novo*. It’s not unreasonable, then, to argue that the following statement in the concluding pages of his *Descent* contains a well-masked form of bait-and-switch to ‘bridge’ the gap: “For the moral qualities are advanced, either directly or indirectly, much more through the effects of habit, the reasoning powers, instruction, religion, &c., than through natural selection; though this latter agency may be safely attributed to the social instincts, which afforded the basis for the development of the moral sense.” Darwin, ref. 15, pp. 688–689.

26. Moll, J. *et al.*, The neural basis of human moral cognition, *Nature Reviews: Neuroscience* 6(10):799, October 2005; pp. 799–809. The extent to which evolution must be held up as a totalizing worldview is clearly comprehended from the following: “In attempting to understand adult human sexual behaviour with children and adolescents, the researcher must realize that although human beings tend to associate sex with love, sex without love or tenderness also exists in humans as part of the archaic vertebrate heritage of the species.” Eibl-Eibesfeldt, I., Dominance, submission, and love: sexual pathologies from the perspective of ethology; in: Feierman, J.R. (Ed.), *Pedophilia: Biosocial dimensions*, Springer-Verlag, NY p. 150, 1990.

27. Cosmides, L. and Tooby, J., Can a general deontic logic capture the facts of human moral reasoning? How the mind interprets social exchange rules and detects cheaters; in: Sinnott-Armstrong, W. (Ed.), *Moral Psychology*, vol. 1, *The Evolution of Morality: Adaptations and innateness*, The MIT Press, Cambridge, MS, pp. 53–54, 2008.

28. Lycan, W.G., What is the ‘subjectivity’ of the mental? *Philosophical Perspectives* 4:109, 1990; pp. 109–130.

29. Any attempt to reduce or define the moral in terms of the non-moral is what G.E. Moore labelled ‘the Naturalistic Fallacy’. For materialism generally, and evolution specifically, this has proved a very difficult logical obstacle to overcome. Nearly all philosophers recognize the problem and try all manner of escapes, none of which solves the dilemma. I will address this important issue in detail in a subsequent part.

30. Naturalism, apropos ethics, maintains that “the complete warrant for any norm or value must be cashed out without invoking the views or commands of a divinity, [that it] should not employ a distinctive *a priori* method of yielding substantive, self-evident and foundational truths from pure conceptual analysis. The claims of ethical naturalism cannot be shielded from empirical testing . . . In other words, ethical science must be continuous with other sciences.” (Flanagan, O., Sarkissian, H. and Wong, D., Naturalizing ethics; in: Sinnott-Armstrong, W., ref. 27, pp. 2, 5.) It’s no carping dressing-down to point out that these three authors’ rejection of an *a priori* analysis in order to derive first-order principles appears to be a disingenuous, partial reintroduction of the now much maligned early 20th century’s Vienna Circle’s Logical Positivism. The Vienna Circle’s epistemological Principle of Verification’s inability to meet its own criterion is ably demonstrated in Naturalism’s philosophical stand. At the very least, it self-refuting commences with an “*a priori* method of yielding substantive, self-evident and foundational truths from pure conceptual analysis”. Oops! For a more detailed exploration of the Positivists’ failed enterprise, see the wonderful debate between Terry Miethe and a ‘pre-converted’ Antony Flew in *Does God Exist?: A believer and an atheist debate*, HarperCollins, NY, 1991. Alex Rosenberg has also so plainly stated, “Among philosophers, naturalism is the view that contemporary scientific theory is the source of solutions to philosophical problems.” (Rosenberg, A., Darwinism in moral philosophy and social theory, in: Hodge J. and Radick, G. (Eds.), *The Cambridge Companion to Darwin*, Cambridge University Press, Cambridge, p. 310, 2003.)

31. Dennett, D.C., *Darwin’s Dangerous Idea: Evolution and the meanings of life*, Touchstone, NY, p. 454, 1995. At first blush such would seem a self-parody of evolutionary speculation. However, Dennett’s comment is intended to be taken as a historical fact. For a more realistic analysis of the problematic nature of mutation fixation and fitness acquisition see Basener, W.F. and Sanford, J.C., The fundamental theorem of natural selection with mutations, *J. Mathematical Biology* 76(7):1589–1622, June 2018.

32. Buchanan, A. and Powell, R., The limits of evolutionary explanations of morality and their implications for moral progress, *Ethics* 126(1):39–40, October 2015; pp. 37–67. A far less redacted ‘history’ is unfurled by Frederick Rauscher. He proposes a combination of necessary and sufficient primary and secondary mechanisms and behaviours which form an explanation for our morally significant dispositions. See his ‘How a Kantian can accept evolutionary metaethics’, *Biology and Philosophy* 12(3):303–326, July 1997; esp. pp. 305–306. Rauscher, as seen by the title of his paper, attempts to wed the Kantian categorical imperative (i.e. the universalization of ethics generally and actual commands more specifically) to biology and a hypothetical set of genes. All this becomes far too ethereal to have much of a bite. For insistence: “Kantian metaethics would thus identify the command which causes humans to behave in cooperative or altruistic ways as the primary phenotypic mechanism. What might such a command be? How might it be encoded in a genotype or expressed as a primary phenotypic mechanism? I can only speculate here . . . Like universal grammar, the structure of actions might be formalizable as a rule or a series of rules which would be encoded in human brain structure” (p. 319). His reference to grammar piggybacks on Chomsky’s work; however, Chomsky has no idea how evolution could create the necessary hardware for grammar and language.

On this last issue I recall Wilder Smith mentioning a letter he wrote to Chomsky asking him where the ultimate source of information lies. Chomsky replied that his mind could not come to grips with the question for the origin of all information. As a metaphysical naturalist, this is not surprising.

33. Buchanan and Powell, ref. 32, pp. 40–41. It needs pointing out that the authors are specifically attacking political conservatives’ use of evolution to underwrite their social policies and moral philosophy.

34. Broom, ref. 22, pp. 22–23. For an alternative vision, though no less fanciful, see Ayala, F., The biological roots of morality, *Biology and Philosophy* 2(3):235–252, July 1987. According to Ayala, it was as a consequence of his developing intellectual capacity, and not because of direct evolutionary adaptive value, that early man gained a moral faculty. However, more frequently than one would expect, evolutionists slip up and present an explanation having all the hallmarks of teleology, anathema to the materialist worldview. For example, “Morality

evolved and developed in order to coordinate and harmonize the interests (both self- and other-regarding) of humans living in mutually dependent communities [it] evolved to shape character and specify worthwhile lives and ideals of behaviour to which to strive." (Flanagan, Sarkissian, and Wong, ref. 30, p. 10.)

35. This large brain presents a further chicken-and-egg problem. Some commentators argue that the brain's rapid emergence gave rise to complex social interactions, such as altruism. Others propose the opposite: humans have big brains because cooperation came first. See, for example, Masters, R.D., Of marmots and men: animal behaviour and human altruism; in: Wispé, L. (Ed.), *Altruism, Sympathy, and Helping: Psychological and sociological principles*, Academic Press, NY, pp. 73–74, 1978.

36. Lance Rips aptly diagnoses question-begging or circular reasoning as a "defect in reasoning [and this i]nability to detect or to break out of circles in one's own thinking may lead to narrow-mindedness, or even delusions, in which one's beliefs about a topic are self-authenticating, sealed off from evidence that might cast doubt upon them." Rips, L., Circular reasoning, *Cognitive Science* 26(6):768, November 2002.

37. Maxwell, M., *Morality among Nations: An evolutionary view*, State University of New York Press, Albany NY, p.6, 1990.

38. Wilson, C., The biological basis and ideational superstructure of morality; in: Campbell, R. and Hunter, B. (Eds.), Moral epistemology naturalized, *Canadian J. Philosophy*, supp. vol. 26, University of Calgary Press, Calgary, pp. 214–215, 2000. These are by no means isolated examples. Owen Flanagan, defending his Humean explanation for the rise of human morality against the one portrayed by Hobbes' 'war of everyone against everyone', begs morality into existence by writing that our "social instincts and proto-moral emotions are there from the start, and thus morality has on its agenda, from the beginning, concern for the welfare of (some) others, as well as for oneself . . . Humans, thanks largely to the possession of a cognitive-conative economy that was passed on from ancestors, have moral or, at least, proto-moral dispositions from the start." Flanagan, O., Ethical expressions: why moralists scowl, frown and smile; in: Hodge, J. and Radick, G. (Eds.), p. 386, ref. 30.

39. Apparently, it was Auguste Comte (1798–1857) who coined the term 'altruism' to indicate an unselfish desire to live for others. However, it's pointed out by Robert Mackintosh that in Comte "The definition of Altruism is never formulated; it is never supported by argument; it is merely taken for granted. None the less it exerts an immense influence in Comte's own system and has spread from it far and wide. Innumerable writers, Christian as well as non-Christian, have come to employ the term 'Altruism' as a synonym for goodness." (Mackintosh, R., *From Comte to Benjamin Kidd: The appeal to biology or evolution for human guidance*, MacMillan and Co., NY, p. 45, 1899.) The term arose as a consequence of his analysis of the underlying tendencies of history and human social evolution. Comte's use is, in itself, one of the great ironies of history as Comte's *raison d'être* was to reject divine agency as an explanation for reality and jettison surrogate explanations based on metaphysical or abstract principles, the latter being a partial reaction to some of Hegel's philosophy. His replacement was pure scientism and humanism. Other writers have described Comte's altruism as "an odd alloy of phrenology, conditioning principles, assumptions about emotional contagion, and utopian moralizing." (Batson, C.D. and Shaw, L.L., Evidence for altruism: toward a pluralism of prosocial motives, *Psychological Inquiry* 2(2):108, 1991.) Will Durant noted that Comte, in his twilight years, was led from his intellectualism to an elevation of feeling by a woman whose husband was spending life in jail. As a result, Comte devised a system of priesthood, prayers, and sacraments: "Comte offered the world all of Catholicism except Christianity." (Durant, W., *The Story of Philosophy: The lives and opinions of the greater philosophers*, Ernest Benn Ltd, London, p. 383, 1927.) Also note Comte's influence on Herbert Spencer, and thus on social Darwinism, as set out in Hovenkamp, H., Evolutionary models in jurisprudence, *Texas Law Review* 64(4):664–671, December 1985; pp. 645–685.

40. Counting numbers of individuals as a measurement of success, and hence fitness, doesn't obviate inherent problems. See Williams, G., *Adaptation and Natural Selection: a critique of some current evolutionary thought*, Princeton University Press, Princeton, NJ, p. 103ff, 1966. Williams lists a number of problems associated with mere numbering and the alternatives utilized by investigators measuring 'success'. These include mass, the rate of change of size of populations, the counter-intuitive population shrinkage as a regulative response to environmental pressure as proposed by Wynne-Edwards, ecological versatility and numerical stability assessed by the amplitude of fluctuation about a long-term mean. One biologist admits that measuring fitness "isn't an absolute mathematical truth, but is often true, in theory." Rose, M.R., *Darwin's Spectre: Evolutionary biology in the modern world*, Princeton University Press, Princeton, NJ, p. 70, 1998.

41. Wilson, ref. 10, p. 3.

42. Wispé, ref. 35, Wispé, L., Toward an integration, p. 308.

43. Harman, O., *The Price of Altruism: George Price and the search for the origins of kindness*, Vintage Books, London, p. 5, 2011. Alternatively, and certainly from out-of-left-field, comes the suggestion that "altruism is a nonadaptive strategy or an 'error' that is still with us because it has not been sufficiently selected against." The author, apparently, has only a luke-warm attachment to this 'solution'. He half-heartedly dismisses it by claiming that it's analogous to the human appendix's being "not evolutionarily useful" but "Still, most of us have an appendix, because its cost has not been sufficient enough for it to be selected against." (Nanay, B., Group selection and our obsession with the meaning of life, *The Monist* 93(1):77, January 2010; pp. 76–95.) It's relatively easy to imagine living in a world without an appendix (I can—I lost mine at age 15!), but a world without altruism and still be a human?

Even before this most modern period of explanations for altruism, there were early misgivings to the extent that "there is *somewhere* a biological limit to altruism, even for man". (Pearl, R., Biology and human progress, *Harper's Magazine* 172:225, January 1936.)

44. This encapsulates the much misunderstood problem of the Naturalistic Fallacy. I address this in some detail in a subsequent part.

45. However, it should be noted that the distinction is not conceptually final, as can be seen from Alexander's description of altruism as "phenotypically (or self) sacrificing but genotypically selfish." (Alexander, R.D., Natural selection and the analysis of human sociality; in: Goulden, C.E. (Ed.), *Changing Scenes in the Natural Sciences*, 1776–1976, The Academy, Philadelphia, p. 294, 1977, as cited in Bertram, B.C.R., Problems with altruism; in: King's College Sociobiology Group (Ed.), *Current Problems in Sociobiology*, Cambridge University Press, Cambridge, p. 255, 1982.) Also, Michael Ruse's cynical, though accurate, depiction of altruism, sociobiologically speaking, as 'enlightened self-interest' follows a similar trajectory. (Ruse, M., Sociobiology: a philosophical analysis; in: Caplan, A.L. (Ed.), *The Sociobiology Debate*, Harper & Row, NY, p. 358, 1978.)

46. Bertram, ref. 45, p. 252. This is an abridged version of Bertram's remark. I've omitted the words "who is not a descendant of the actor", which follow "the same species", as some evolutionists have pointed out that kin selection, to be discussed in an upcoming part, is an important explanation for altruism. Furthermore, preferential treatment in one's offspring does occur and some have used this, albeit rather tendentiously and tenuously, as yet another aid to explain altruism. Whatever the case may be, excluding relatives would not accurately represent the full description of biological altruism. The whole of Bertram's contribution identifies a number of problems with various definitions and is valuable for this alone.

47. Wilson, ref. 10, p. 121. However, since publishing his major work, Wilson has had a change of mind regarding the efficacy of kin selection to explain altruism. See Nowak, M.A., Tarnita, C.E., and Wilson, E.O., The evolution of eusociality, *Nature* 466:1057–1062, 26 August 2010. Also, note the danger of relying on nature in order to locate explanation (and possibly justification) for human nature. This is perhaps no better evinced than in the remarkable discovery of slave ants. This occurred at the same time the 19th-century Abolitionist movement was underway, and the observation that servants tended to be black lent considerable support to the pro-slavery argument and unsettled the emancipists. See Desmond, A. and Moore, J., *Darwin's Sacred Cause: How a hatred of slavery shaped Darwin's views on human evolution*, Houghton Mifflin Harcourt, Boston, MA, pp. 222–224, 301–304, 2009.

48. On this point see Shavit, A., Shifting values partly explain the debate over group selection, *Studies in History and Philosophy of Biological and Biomedical Sciences* 35(4):697–720, December 2004.

49. I would like to thank two anonymous reviewers and David Green for their input and valuable corrections.

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The implications of Chaos Theory for understanding creation

Andrew Sibley

Chaos Theory may shape our understanding of biblical creation. An outline of the theological issues that arise will follow on from a historical sketch. Although, historically, some have considered the findings to be worrying for a proper appreciation of the creation, it does in fact lead to a deeper understanding of the power and wisdom of God. Regarding the theological aspects, it is necessary to consider whether Chaos Theory should apply to the pre-Fall world. Lastly, the paper discusses how Chaos Theory may also call into question secular dating methods, and shows that theories of self-organization, which are postulated in support of evolution, are inadequate.

Chaos Theory poses some challenges for the biblical creation position, and yet there have only been a few articles or papers in related publications;^{1,2} there is more comment in secular literature.³ This paper examines how Chaos Theory developed over time, and shows that it may actually enhance, not reduce, our understanding of the power and wisdom of the Creator. The theological aspect will also be considered, with a discussion about whether Chaos Theory should be applied to the pre-Fall world. The case is made that Chaos Theory calls into question the secular dating methods regarding prehistory. It is further highlighted how weak Chaos Theory is in offering evidence for theories of self-organisation.

It is relevant to note that there is a correlation between Chaos Theory and entropy; both seek to describe the observation that physical systems become more disordered over time, although they are not exactly the same. With entropy, scientists can state deterministically the start and end of a physical process; with Chaos Theory, while there is a degree of uncertainty over starting conditions, the end point is ultimately unpredictable. Entropy may deal with the properties of a substance (such as a gas) as a whole, while Chaos Theory describes changes occurring within part of the system. However, for the purposes of this discussion the principles inherent in Chaos Theory are considered to be a form of entropy.

What is Chaos Theory? An historical study

In the early modern period, many philosophers of science viewed the universe in the shadow of Greek thinking, especially within the framework of Aristotle's writing (the student of Plato). His assertions in *On the Heavens* held that the heavenly bodies were unblemished spheres, composed of aether, and traced out perfectly circular and deterministic

orbits.⁴ This was reflective of ideal shapes formed in the mind of a perfect designer. Thomas Aquinas later supported and adapted this view to make it fit with the doctrines of the Catholic Church.⁵ The orbits of the planets were considered perfect, with the earth at the centre. This is often referred to as the geocentric or Ptolemaic system. But, despite this belief in perfect orbits, observational evidence showed that planets exhibit retrograde movement on occasions, which led to the *ad hoc* postulation of epicycles. This overall system was questioned by some medieval natural philosopher/clergymen such as Buridan and Oresme, who showed that the earth could be moving. Then the system was challenged outright by Copernicus and Galileo, who argued instead for a heliocentric view of the solar system. With the invention of the telescope, the presence of craters on the moon and the observation of sunspots also brought into question the perfection of the astronomical bodies.

Heliocentrism became widely accepted in later centuries, although a belief in the perfection of orbits was still widely held. (Galileo's contemporary Kepler showed that the orbits were closer to perfect *ellipses*.) This was exemplified by a dialogue between Gottfried Leibniz and Samuel Clarke in 1715/1716, where Clarke was essentially defending Isaac Newton's position.⁶ Newton had proposed that, because of gravitational attraction and interaction between the planets and comets, the original order of the heavenly bodies given by 'the counsel of an intelligent being' had been disturbed. As such, the interaction between the bodies had led to a loss of order in the solar system, albeit measurable over 'many ages' (see below). This explanation, he argued, was preferable to the view that the order had arisen by laws of nature out of chaos and fate:⁷

"And if he did so, it's unphilosophical to seek for any other Origin of the World, or to pretend that it might arise out of a Chaos by the mere Laws of Nature;

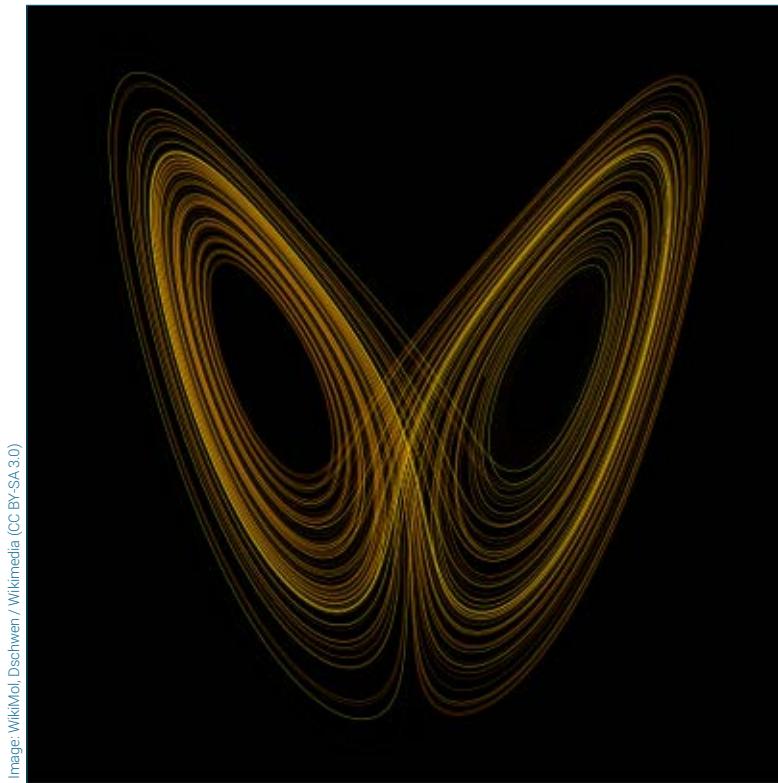


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Figure 1. The Lorenz attractor, a well-known exemplar of Chaos Theory, sometimes called a butterfly diagram

though being once form'd, it may continue by those Laws for many Ages. For while Comets move in very excentrick Orbs in all manner of Positions, blind Fate could never make all the Planets move one and the same way in Orbs concentrick, some inconsiderable Irregularities excepted which may have risen from the mutual Actions of Comets and Planets upon one another, and which will be apt to increase, till this System wants a Reformation. Such a wonderful Uniformity in the Planetary System must be allowed the Effect of Choice.”⁸

Newton was here anticipating the later description of Chaos Theory, although thinking that periodic interventions, or divine *Reformations*, would be sometimes necessary to restore that order; that is, allowing God freedom to work within the system to maintain order. But in response, Leibniz proposed that the universe was set up with laws in such a way that it could run continually without the intervention of God—anything else, he believed, would diminish the Creator. He wrote:

“In my view, the world always contains the same force and energy, which changes only by passing from one material thing to another in accordance with the laws of nature and the beautiful order pre-established.

And I hold that when God works miracles, he does it not to meet the needs of nature but the needs of grace. Anyone who thinks differently must have a very mean notion of the wisdom and power of God.”⁹

Newton's close acquaintance, Samuel Clarke, responded in a letter of 26 November 1715. He pointed out that God is necessarily at work in sustaining the creation in its ongoing operation, and that it is misguided to consider the cosmos as a perfect clock or machine. That position would essentially exclude God from the world, and lead to deism and atheism. He wrote:

“... as well as assembling things into structures, he is himself the author and continual preserver of their basic forces or powers of motion. ... The idea that the world is a great machine that goes on without intervention by God, like a clock ticking along without help from a clockmaker—that's the idea of *materialism* and *fate*. Under cover of declaring God to be a *supramundane intelligence*, it aims to exclude providence and God's government from the world [emphases in original].”⁹

Clarke elaborated further (in a letter of 10 January 1716) that the present laws of motion, and any amendments, are all part of God's design from the beginning.⁹ However, this subtlety was lost on many scientists. With ongoing overconfidence in the explanatory power of science, continuing well into the 19th century, Pierre-Simon Laplace still argued along deterministic lines. He commented that if the starting conditions were known, then it would be possible to predict the future perfectly.⁷ But the solar system is, in reality, more complex than this. While Newton's Theory of Gravity could predict the movement of a two-body orbiting system deterministically, such as the sun and Earth, or Earth and the moon, the equations of motion become increasingly unresolvable when a third body is added (for example, sun–Earth–moon). This three-body problem was discussed by the French mathematician Henri Poincaré in 1887.

The resolution to the problem involved the prediction of the movements and positions of the three bodies in very small time steps. This entailed running the equations iteratively through a lengthy modelling process; that is, recalculating the solution many times, with the new data applied at each new step.¹⁰ This process can be applied to the prediction of the movement of asteroids, and to weather forecasting. But, in reality, it is far too laborious even for a room full of mathematicians; Lewis Fry Richardson had imagined just

this scenario.¹¹ Instead it requires the data-crunching power of super computers.

Edward Lorenz was one of the first to conduct meteorological experiments with computerized simulations in the 1950s and 1960s, essentially using an early numerical weather prediction (NWP) model that utilized non-linear differential equations:

$$\begin{aligned} dx/dt &= -\sigma x + \sigma y; \\ dy/dt &= rx - y + xz; \\ dz/dt &= xy - bz. \end{aligned}$$

Modern weather forecasting models work along similar lines, involving fairly simple equations, but very powerful computers. The NWP computer models work with nonlinear differential equations and divide the weather system three-dimensionally into small grid boxes. Then they are run forwards in time with short time steps.

In his work, Lorenz observed that solutions may vary considerably over time due to tiny differences in starting conditions. During one experiment he stopped the program half-way through, and then started it again from that mid-point, utilizing the most recent data displayed by the computer. The outcome was markedly different than expected. He later discovered that, although the computer had displayed the numbers to 3 decimal places, internally the system was working to 6 decimal places. Evidently, large differences had come from small changes, even at the level of the rounding of numbers in the computer. The findings were referred to as Deterministic Nonperiodic Flow in the paper.¹²

The implication is that very tiny initial variations can cause large differences over time because of the compounding of errors. As well as the problem of rounding of numbers in the computer, in reality there is also uncertainty in the initial observations. The well-known analogy that Lorenz developed referred to the flapping of a butterfly's wings: "Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?"¹³—although originally it involved the flapping of the wings of a seagull.

"One meteorologist remarked that if the theory were correct, one flap of a seagull's wings would be enough to alter the course of the weather forever. The controversy has not yet been settled, but the most recent evidence seems to favor the seagulls."¹⁴

This particular analogy is probably not feasible because of dampening in the atmosphere, but it does highlight how very small initial differences can cause more significant divergence later in time. Errors are compounded as the model runs forwards. In the physical world, this tendency towards greater randomness and disorder is a form of entropy. To deal with this level of uncertainty, meteorological NWP models are run multiple times, referred to as *Ensemble Modelling*.

This allows for the probability of different outcomes to be calculated. One tool for assessing the confidence of a particular ensemble is the use of a measure called *Shannon Entropy*.¹⁵ It provides a measure of the amount of useful information in the forecast model output over time, set against climatology. As you would expect, the useable information in the model decreases with time.

While Chaos Theory leads to diverging outcomes in this way, there are also attractors that limit the divergence; in both mathematical models, and in physical reality (figure 1). These attractors lead to *fractals*, where beautiful patterns may emerge on the edge of apparent chaos (figure 2). Weather systems follow similar patterns, where, for example, tropical cyclones (figure 3) or mid-latitude depressions are limited by the hydrodynamic and thermodynamic equations of the atmosphere, and geographical features.

Within chaotic systems there is a combination of deterministic equations that plays out through chaotic motion and complex physical interactions, together with limiting attractors. Despite varying starting parameters, the same equations normally produce a series of outcomes through the iterative process that are increasingly concentrated around a specific set of parameter values; this is referred to as the 'attractor'. This combination often leads to beautiful structures in nature, such as weather systems, the rings of Saturn, and arguably galaxies.¹⁶

"Big whirls have little whirls that feed on their velocity, and little whirls have lesser whirls and so on to viscosity."¹⁷

The reality of these features in creation leads to a greater appreciation of the wisdom and intelligence of the Creator; more so than the purely mechanical, or clockwork view of the universe. However, the term Chaos Theory is perhaps a misnomer. Perhaps complexity theory might be more appropriate as the outcomes of modelling such systems are unpredictable.

The narrative of secular science is that God has been removed from the scene as science has advanced. The rejection of geocentrism and a greater understanding of the complexity of the world leads to a deeper understanding of the power and wisdom of the Creator.

Chaos Theory and the pre-Fall world—the biblical text

While we can see chaotic forces at work in the present world, we may also think about the implications of this theory for the pre-Fall world. We are informed in Scripture that the creation was 'very good' (Gen. 1:31), and a place where Adam and Eve could potentially live forever. How could chaotic forces be at work in such an environment? It may also be asked whether the meaning of 'very good' in



Image: Fairy / Wikimedia (Public Domain, CC0 1.0)

Figure 2. The Barnsley Fern. A fractal named after the mathematician Michael Barnsley, described in his book *Fractals Everywhere* (Academic Press, Boston MA, 1993). It was produced to resemble the fern black spleenwort, *Asplenium adiantum-nigrum*.

Genesis 1:31 implies perfection (good: *tōb* טוב; very: *mə'ōd* מְאֹד). In the context of the passage the creation was stated to be ‘good’ on six occasions (Gen. 1: 4, 10, 12, 18, 21, 25), and ‘very good’ only on the seventh time, after the creation was *complete*.

Some notable Christians over the years have interpreted ‘very good’ to mean perfection; including, for example, Henry Morris, who believed that the Second Law of Thermodynamics began at the Fall,¹⁸ and John Calvin. Calvin, in his *Commentary on Genesis*, also uses the word ‘perfection’ when discussing the meaning of this verse. The English translation accurately captures the Latin:

“But now, after the workmanship of the world was complete in all its parts, and had received, if I may so speak, the last finishing touch, he pronounces it perfectly good [Latin: *perfectè bonum*]; that we may know that there is in the symmetry of God’s works the highest perfection [Latin: *perfectionem*], to which nothing can be added.”¹⁹

Danny Faulkner and Lee Anderson have both argued that ‘very good’ implies completeness, but that this does not necessarily imply a view of perfection which goes beyond the concept of goodness.^{20–22} This view, they argue, allows room for the Second Law of Thermodynamics to be in

operation, albeit in some rather limited way. For Faulkner, this includes such possibilities as crystals not requiring perfect internal structures. Sarfati broadly concurred regarding entropy, and proposed that God, through His sustaining power, was able to counteract the effect of the Second Law of Thermodynamics prior to the Fall, even while entropy was a reality in some limited form.²³ Examples of such entropy include the digestion of food, respiration, and the radiant heat transfer from the sun to Earth. Clearly these are ongoing and necessary processes in the pre-Fall world. The implication is that God was necessarily sustaining the created system in perpetuity; just as the shoes of the Israelites in the wilderness did not wear out.²³

The idea of physical perfection is also based upon the Aristotelian view of the planetary bodies possessing unblemished characteristics in terms of ideal shape and orbital plains, although for Aristotle the earth and planets were made of different material (earth and aether). The creation account does seem to describe a place where there were flowing rivers, which implies hills and mountains; thus, this would not qualify as perfect in terms of a Greek view of the heavenly bodies, but would qualify as ‘very good’ in terms of fulfilling God’s plan.

The Greek Old Testament (Septuagint) translates ‘very good’ as καλὰ λίαν (*kalá lián*), implying an intrinsic benevolence in the created order. The word καλός (*kalos*) is used in the New Testament to mean that something is directed towards its end goal (Matt. 12:33; Rom. 7:16); or it is used in terms of being moral or honourable, or acting in line with righteousness (Gal. 4:18). The divine statement ‘very good’ then implies that creation was complete, a sacred place, and ethically in line with the will of God. The Hebrew meaning is that of original goodness and completeness, not Aristotelian perfection.

The Apostle Paul also provides a commentary on the Genesis passage in Romans 8, particularly in terms of shedding light on the Fall, as recorded in Genesis 3.²⁴ Romans 8:19–21 reads as follows:

“For the creation waits with eager longing for the revealing of the sons of God. For the creation was subjected to futility, not willingly, but because of him who subjected it, in hope that the creation itself will be set free from its bondage to corruption and obtain the freedom of the glory of the children of God.”

The two words of interest here are ‘futility’ (or *vanity* in the KJV), and ‘corruption’ (NIV has *decay*). In the Greek they are defined as follows:

Futility = *mataiotēti*, ματαιότητη. It implies an emptying or loss of something spiritual in the creation, so that it is not currently fulfilling its original purpose.

Corruption = *phthoras*, φθορᾶς. The word is used here to imply that something has fallen to a lesser state, in this case in terms of contrasting the fallen physical world with a more spiritual standard. Decay or corruption then convey a fairly clear meaning, but in the context of the wider passage *phthoras* has a clear spiritual implication.

The context in Romans 8 is that the created world has been bound over by God’s decree to a lesser, more carnal and corrupted, state, with the loss or emptying of something spiritual as a result of the Fall. Even so, the Fall had physical consequences, including death for Adam and his offspring; for example, God said:

“Cursed is the ground because of you By the sweat of your face you shall eat bread, till you return to the ground, for out of it you were taken; for you are dust, and to dust you shall return” (Gen. 3:17, 19).

It was a spiritual Fall that (through the consequent Divine curse) led to decay, corruption, and physical death. Biblical creationists need to remember the spiritual loss when discussing the effects of the Fall, and not just think of the pre-Fall world in physical terms. God’s presence was more strongly felt in the pre-Fall world, with His sustaining power holding all things together against the effect of the ever-present entropy. Christ is still upholding all things by His powerful Word, but it is now subject to the Curse (Heb. 1:3; Col. 1:17).

Chaos Theory and the pre-Fall world—theology and science

This discussion has noted the reality of entropy in limited form in the pre-Fall world, but what of Chaos Theory? For example, how should we describe the movement of weather systems and planetary bodies in such a ‘very good’ setting? The creation account describes the creation of the moon, planets, stars, flowing rivers, seas, and an atmosphere where birds fly. Birds generate lift by flapping their wings and generating mini-vortices, as do fish with their fins as they swim in the rivers and sea.

When we think about the mathematical laws and dynamics of such systems, we need to consider the three-body problem, which leads to Chaos Theory as the more accurate modelling approach. It is hard to imagine the pre-Fall world as a place where chaotic systems (i.e. complex, unpredictable systems)

were not present, if we assume it is right to apply similar physical laws and mathematics to such a place/time.

Even so, we can see Adam and Eve living in a protected space in the Garden of Eden. We are told in Gen. 3:22 (compare Gen. 2:17) that they would have lived for ever had they not eaten the forbidden fruit, of the Tree of the Knowledge of Good and Evil. Despite the presence of chaotic systems, we may assume that it was a place where, for example, the weather was universally benign, and where asteroids did not impact the earth—it was a place protected by the providence of God.²⁵

Faulkner has argued for the chaotic asteroid bombardment and cratering of the moon on Day 4 of the Creation Week,²⁶ although we see that various vegetation was already created on Day 3 (Genesis 1:11–13). This suggests the earth was already a protected planet. Although moon cratering on Day 4 is possible within the context of the meaning of *very good*, another solution is that the cratering occurred at the time of the Flood.²⁷ We are faced with the dilemma of modelling a world where Chaos Theory may apply, but at the same time is protected from the worst outcomes of chaotic motion. There is a solution to this problem, when it is recognized that diverging outcomes are dependent upon very small differences in starting conditions.

Within the divine action debate, we are faced with two extreme positions: either a clockwork universe that supports a deistic view of the world, or a place where God must actively determine every change, even at the level of quantum mechanics. In the latter, God becomes a sort of cosmic juggler. However, we may note that the universe runs according to laws, spoken into existence by God at creation, and sustained by His Word. Matter irresistibly follows those rules, and yet God also can countermand or add to those laws. Chaos Theory allows for God to actively intervene in creation, even in minimal ways.

The fact that very small, imperceptible changes in starting conditions can have observable outcomes, often very different ones, implies that God could actively adjust the created system in order to bring about a desired benevolent outcome—even in ways that are not scientifically discernible. This possibility of divine action in creation, in ways that could not be detected by science, has, for example, been discussed by John Polkinghorne.²⁸ From this, it is possible to accept the reality of Chaos Theory in the universe before the Fall, while accepting that it is a world that is also upheld and protected by the sustaining power and goodness of God.

The existence of chaotic systems, considered in isolation, does not necessarily imply decay, but it does illuminate the wisdom of the Creator, and the wonder and beauty of creation. The unpredictability of the world also makes it both more interesting and challenging, and directs the believer towards a life of prayer and faith. Essentially, Chaos



Image: NASA / Wikimedia (Public Domain)

Figure 3. Hurricane Katrina, 28 August 2005

Theory is an empirical construct to describe the complexity of physical processes. Modelling chaotic systems, such as the movements of weather systems or asteroids, involves complex mathematics. This can be illustrated with beautiful diagrams from more simple mathematical equations (figure 1).

Chaos Theory, evolution, and Shannon Entropy

There are two ways that Chaos Theory interacts with evolutionary science: 1) the search for theories of self-organization in biology, and 2) the effect of *Shannon Entropy* on the modelling of history, especially prehistory.

There are various ideas around self-organization in evolutionary science, including those that connect Chaos Theory with a belief in emergent order on the edge of chaos, such as fractals. This has been discussed by, for example, Stuart Kauffman.²⁹ Yet Kauffman doubts that evolutionary

science can make much headway in describing the outcomes scientifically; and is not even able to “finitely prestate the configuration space of a biosphere”³⁰ Although Chaos Theory plays a part in this uncertainty, there are other factors that come into effect. He writes:

“So the biosphere, it seems, in its persistent evolution, is doing something literally incalculable, nonalgorithmic, and outside our capacity to predict, not due to quantum uncertainty alone, nor deterministic chaos alone, but for a different, equally, or profound reason [sic]: Emergence and persistent creativity in the physical universe is real.”³¹

He recognizes that there is difficulty in determining biological processes through scientific algorithms because of the way in which open, non-equilibrium, thermodynamic systems operate. Such systems function like universal Turing machines, where it is not possible to prestate the organization of the system in terms of its “configuration space, variables, laws, initial and boundary conditions”—it follows, he thinks, that a general law for all open thermodynamic systems cannot exist.³² Despite this doubt, some scientists have proposed the existence of a fourth law of thermodynamics for non-equilibrium systems in terms of the ‘steepest entropy ascent’.³²

Kauffman, however, refers to his investigations as ‘serious protoscience’, and suggests that evolutionary science is forced to rely upon artistic narratives, not just science; “Biospheres demand their Shakespeares as well as their Newtons”, he proposed.³³ There are good reasons to think that emergent order on the edge of chaos does not offer much help to evolutionary science, especially when it is not possible to prestate the starting conditions.

Shannon Entropy and modelling the past

In trying to model dynamical, physical processes, Chaos Theory also leads to the problem of decreasing information in the outcome; referred to as *Shannon Entropy*.¹⁵ It is usually applied to future predictions in meteorological ensemble modelling processes. As the ensemble, with multiple model runs, progresses forwards in time, beyond about 5 to 7 days, it becomes increasingly hard to find usable information in the forecast against a background of normal climatology. However, it is proposed that this problem also applies to

modelling the past. This was also discussed by Price and Carter, who refer to it as the ‘Malcolm Effect’, from *Jurassic Park*.^{2,34} As we seek to determine history or prehistory, we are faced with a decreasing amount of usable information the further back in time we go. Dating methods, for example, rely upon untestable assumptions regarding prehistory, and calibration errors apply to data collected over short time intervals, which are then extrapolated into the distant past. Creation scientists have often pointed out uncertainties inherent in radiometric dating methods.³⁵

Summary

In terms of evolution, Chaos Theory need not be a problem for biblical creation, and instead enhances our appreciation of the power and wisdom of the Designer. The divine agent is free and able to interact with creation, even in ways that are scientifically undetectable.

Chaos Theory does pose a problem for explaining the increasing complexity of life, and involves the reliance upon narratives as opposed to pure science. It also highlights that piecing together the past, as prehistory, is hindered by random events, and changing variables in ways that are unpredictable. Thus, categorical statements about the past by naturalistic scientists are unsustainable.

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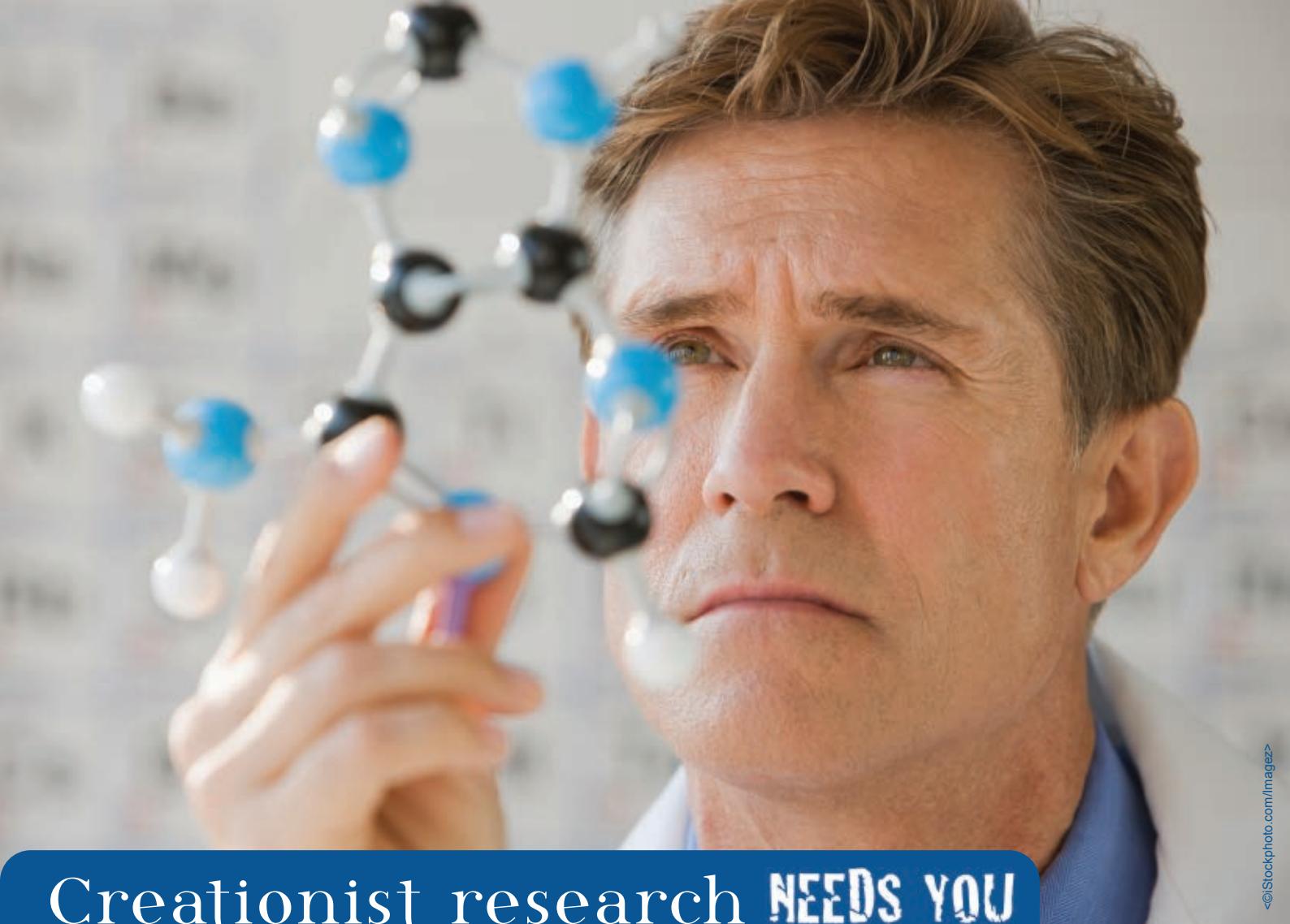
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